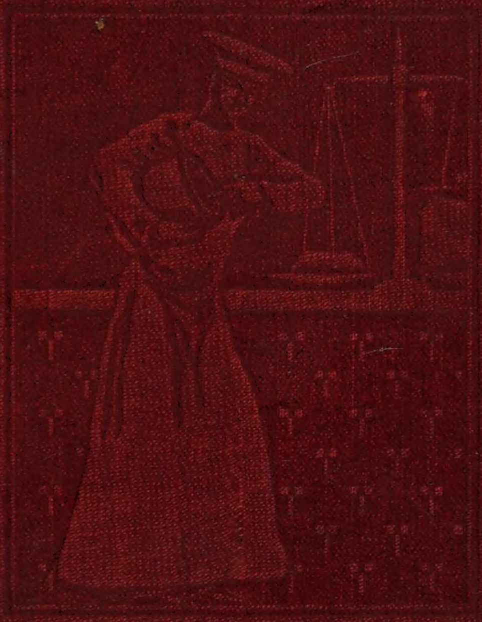

THE MODERN BAKER
CONFECTIONER AND CATERER

SPECIMENS OF CHOCOLATE PAINTING

THE MODERN BAKER CONFECTIONER AND CATERER

BY

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With Contributions from Specialists & Trade Experts

NEW AND REVISED EDITION

VOLUME IV

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THE MODERN BAKER
CONFECTIONER AND CATERER

VOLUME IV

CHAPTER I

BAKERY OVENS

Having dealt exhaustively with matters relating to restaurants and catering, we now return to the bakery, its fixtures and fittings, machinery, &c.

There is steady development going on in appliances, and engineers are making an effort to cater for the wants of the small baker. The shortening of the hours of labour has made it necessary that even the small employer must economize his time, and there is therefore an ever-growing market for labour-saving appliances. It is no longer economical to make dough by hand, however small the business; any baker who has rolls or small goods to make must have a bun-divider. Lifts and conveyors from the bakery to the store must come also for the small business.

Importance of Good Ovens.

When one opens a new bakery or takes over an old one there is no part of the fixtures to which more attention should be paid than the ovens. The youth anxious to make a start on his own account somehow, is prone to think that any kind of oven will do *for a start*, and is not particular enough as to his requirements in his agreement with the landlord; or, if he pays for the oven himself, chooses one that is cheap to construct without satisfying himself that it is also efficient and economical. When an oven is gluttonous for fuel and loses heat quickly on account of bad construction, the accumulating yet unseen waste from these sources may really make an otherwise profitable business into one in which ends do not meet.

Essentials of a Good Oven.

The essentials in an oven are that it should be an efficient baker in which top and bottom heat should always bear a steady relation to each other, and yet one in which it is possible to produce top or flash heat at will; after being solidly heated it should be so constructed as not to lose heat except in performing the work for which it has been designed; it should be easy to heat with only a moderate

quantity of fuel. That an oven should be clean may be considered as an extra essential—not because cleanness in itself is not wholly desirable, but because it is quite possible to have an oven that in ordinary circumstances may appear not clean, and yet by care and systematic cleaning can be made to satisfy the most exacting in the clean and efficient manner in which it can be made to bake all that is required, while on the other hand there are ovens in which every care has been taken to ensure cleanliness and yet out of which goods may be produced in a dirty condition. It is noticeable that when everything has been done to prevent dirt or dust in the oven, the bakers may readily take much less care to remove that which does accumulate than in the other case where the removal of dust, &c., is so necessary a part of the routine work before any baking whatever can be done. This is the explanation of the fact that the cleanness of the goods from such types of ovens as the Scotch or the side-flue compares very favourably with the goods from the steam-pipe and other types of externally heated ovens.

Value of Appearance.

The bright exterior and ornamental fittings of an oven, desirable as these may be, are also to be classed as extras. They give an air of brightness and lightness to a bakery that are not without effect on the men, who may on account of their surroundings become brighter and go about their work in a better and more active spirit, which is a factor in the production of good work. But embellishments do not add to the efficiency of an oven, while they may add very materially to its cost. Yet when the substantiality of the structure is assured, and the furnace, wherever it is situated, is made of material that will withstand the enormous heat to which it will be subjected, when the doors are proved to be tight and properly fitted, then there are some kinds of ornamentation that should always be preferred even if they do add slightly to the cost. Thus all the bright work about oven doors, and wheels and rods to work doors of drawplates, should be plated instead of being merely polished. The plating detracts nothing from their strength, lasts about as long as the fittings, and prevents constant rusting by the steam from the oven. Whenever possible the front wall of an oven should be of glazed brick with one or two rows of coloured bricks as relief from the pure white.

The Best Oven.

Those about to build ovens are always anxious to know which is the "best oven", and nearly every oven-builder is prepared to vouch that his is the best. It is surprising what results can be secured with care out of the oldest and oldest-fashioned ovens. But as there has been a constant change in the manner of heating ovens, although not necessarily in the ovens themselves, there was evidently a demand for the changes, and they have had a marketable value, although not all the changes have really been improvements.

Simplest Kind of Oven.

The very simplest kind of oven, examples of which are still in daily use in our own and in many other countries, consists of a single brick or stone structure with no opening whatever

into it except the oven door. That door may be a simple iron plate without hinges but with two handles. The chimney, which is generally a wide aperture, is above the oven stock, and has no direct communication with the oven chamber, or indeed with the fire the gaseous products of which it is required to carry away, except the same aperture that serves for the oven door. Fig. 188 shows a section of such an oven and indicates roughly the manner of heating. Some forty years ago ovens of this type were almost universal in country towns in Scotland, in Ireland, and generally in the south of England. In Ireland the fuel burned was peat, a heap of which was set alight in the centre or at one side of the oven, on the bottom without any furnace bars; when this was partly burned down the remains of the fire were scattered over the whole oven bottom, and left till the embers burned out.

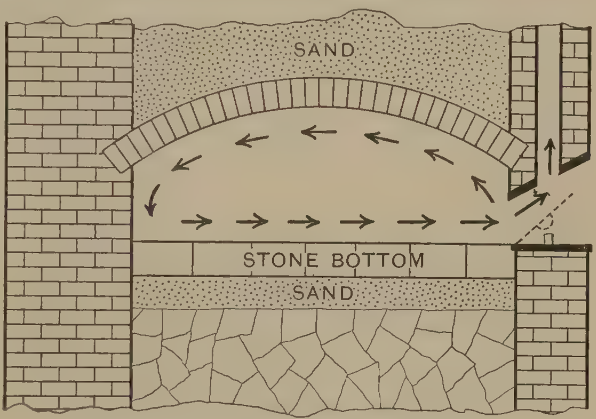


Fig. 188.—Section of Old-type Oven for Peat or Wood

In the English type of ovens of this class the fuel burned was mostly wood. Faggots were set alight in one side of the oven or in several places at the same time, but always on the oven bottom, and these with additions were allowed to burn till the whole oven was sufficiently heated. The air supply, to burn the peat or wood as the case might be, entered by the oven door, and the products of combustion found a passage to the chimney through the upper part of the same door. The English and Irish types of this class of oven had a flue, opening directly into the oven, long before the same arrangements were adopted in connection with the Scotch type. The burning of the fuel in the former type was conducted with closed door and open damper.

Old Scotch Ovens.

The Scotch ovens of the old type, which will be vividly remembered by some of the older men still actively engaged in the trade, were mostly built of stone, except perhaps the crown. The stone bottom or sole was about 6 or 8 in. thick, generally laid on a bed of sand solidly filled underneath with stones or gravel. The door, generally referred to as the "back", was set in position when the oven was being heated in the manner shown in the section (fig. 188) by the dotted line, the sloping position being maintained by a brick placed under the handles. In this case as coal was the commoner fuel, especially in the districts where coal was comparatively plentiful, a form of grating had to be used so that the draught might get fairly under the fire. Fig. 189 represents such a grating. This was cast all in one piece, and stood on three short feet about 2 in.

high. It was pushed into the corner of the oven by using an iron hook on a wooden handle. There was an iron fender (fig. 190) placed in position around it to keep the great heap of coal which formed the night's fire in position on the "chaffer bottom". The procedure in heating the oven was to pile on about a hundredweight of coal—ordinary soft kind—on a fire already made with wood at night after the day's work was done, and to set the "back" on the slope so that there was an opening about 3 in. wide at the top. This arrangement kept the coal burning very slowly for twelve or thirteen hours, the oven chamber for the first part of the time being filled with thick smoke and a dull red flame, but afterwards with a moderately bright fire, really of coke, after all the gaseous matter had been driven out of the coal and burned. The radiation from this fire, continued as it was for several hours, was sufficient, along with the hot currents of heated products from it, to heat the oven interior thoroughly.

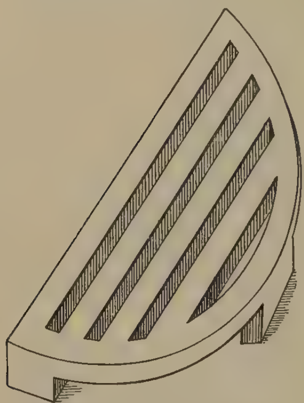


Fig. 189.—Corner Chaffer for Coal-fired Scotch Oven

Management of the Old Scotch Oven. The first work in the morning was to draw the greater part of the remaining fire from the oven, leaving sufficient to retain a strong top heat for the baking of morning goods and sufficient to light the clumps of wood that were thrown on when the top heat required to be augmented. The heat in ovens of this type was necessarily "solid", because the whole structure of the oven was solid and was heated in all its material to a high degree of intensity. The sole or bottom of the oven, made of thick stone, retained its heat for the whole day's baking; the crown, which at its centre was never less than 3 ft. from the sole, was also well heated, and on account of a thick layer of soot which always covered it the heat was radiated slowly, and the solid brick thus retained its heat for a long time. It was part of the ordinary routine work of the bakery to remove the soot from the oven crown with a long rough brush at least three times a week, and the combustion of coal was so incomplete that pendants of soot $1\frac{1}{2}$ or 2 in. long completely covered the back of the oven crown. When the batch was about to be set the fire was completely drawn from the oven, so that the bread was baked in a heated and rather dirty stone pot. With such an oven the greatest skill and care were needed on the part of the workmen to ensure cleanness of the goods baked, and as customers would not take them otherwise the use of those old ovens served as an excellent training of

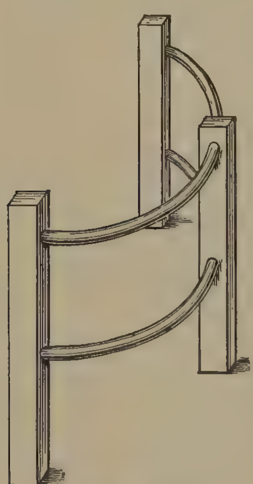


Fig. 190.—Fender

careful workmen, and dirty and troublesome as they were some old-school bakers were loth to part with them even when something better was offered. It is doubtful if there are any of those old ovens still in use in Scotland, but in Holland ovens of similar type in which the fuel is peat are in use for baking rye bread.

Fig. 191.—Oven Blower

The Wagon Oven.

The oven types were ultimately changed, but strangely enough the method of change was different in the three countries named. Thus in some parts of England, notably in Lancashire, the older pot type was altered into the form still much in use in the county, which is designated "the wagon oven". To convert a pot oven as described into a wagon oven it was only necessary to enclose the chimney with an iron box, around the bottom of which another movable iron box called a blower, with handles, could be fitted, with an opening through it for a large pipe. Fig. 191 shows such a box. The small hole in the upper part is intended as a peephole to ascertain the condition of the fire. This box and the other fittings are from photographs taken quite recently, all the appliances shown being still in actual use. The wagon or movable chaffer consists of an ashbox and a firebox (fig. 192). The ashbox has two flanges at one end into which a long iron pipe is fitted, this pipe passing through the opening already alluded to in the box forming the oven door. The firebox fits on top of the ashbox, and as its name indicates contains the fire (fig. 193). The long pipe passing through the hole in the door conveys the air for the combustion of the coal through the ashbox, and up through the fire the products of combustion pass along the roof back to the box at the door and up the chimney.

Ash Box Hopper or Fire Box

Fig. 192

The strength of the draught can be regulated by a damper fixed at the bottom of the chimney. As the fire burns, the position of the wagon in the oven is altered, one of the lengths of pipe being removed as the wagon is pulled down nearer the front of the oven; or if the firing is started near the front, the second length of pipe can be added as the wagon is pushed towards the back of the oven. This type of oven is a great improvement on the original pot oven. The crown can be burned clear and free from soot owing to the strong draught produced through the pipe. Then the intensity of the heat of the crown is greater than in the old form, and a flash heat can be produced readily, time being allowed, by burning another fire. The persistency of this type of oven in some parts of Lancashire, where it has been common for about ninety years, is testimony to its

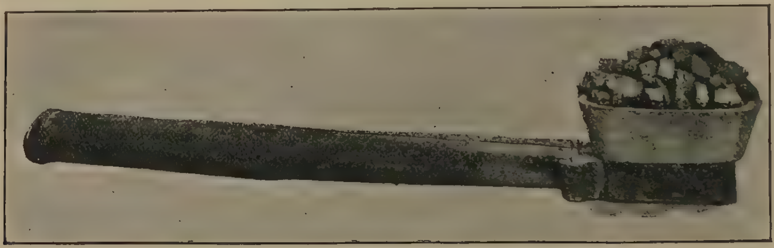


Fig. 193.—Wagon ready for Lighting, showing Draught Pipe

possession of many good points, although it is undoubtedly both troublesome and dirty.

The change from the old pot oven to a variety of the blast type was of much more recent date in Scotland, and the change took a different form. The first alterations required no great structural changes in the oven itself, except that the chaffer and fender were discarded, and in their place a cast-iron set of furnace bars, all in one piece, were fixed, generally in a large block of firebrick, in one corner of the oven. The set of firebars are about 16 in. long by 10 or 12 in. wide. Fig. 194 shows their position in the oven bottom. An ashpit with door was cut through the wall under the furnace bars. The fuel was changed from soft coal to gas coke or anthracite coal. To keep the fuel on the bars a broad piece of iron bent at right angles formed a fender. The old chimney was, in the first instance, continued in use, but, as in the case of the wagon oven, it was reduced in size by boxing in with sheet iron; then a box exactly like that shown in fig. 192, but without the large pipe-hole, was placed over the oven mouth, and really formed the opening to the flue or chimney. The air to supply the fire enters by the ashpit door. The products of combustion pass across the roof to the back wall, are then forced to descend there, and they return across the oven at the level of the top of the oven door, and pass through the box up the chimney. This arrangement ensures a very considerable draught, and as sufficient air can be admitted to burn the fuel properly, the crown of the oven becomes

Modern Scotch Oven.

quite clean and bright, and more intensely heated than was possible with the older type, the absence of smoke from the fuel also contributing to the same end. But the iron box or "blower" was merely a temporary expedient, and was soon superseded by an arrangement exactly similar to

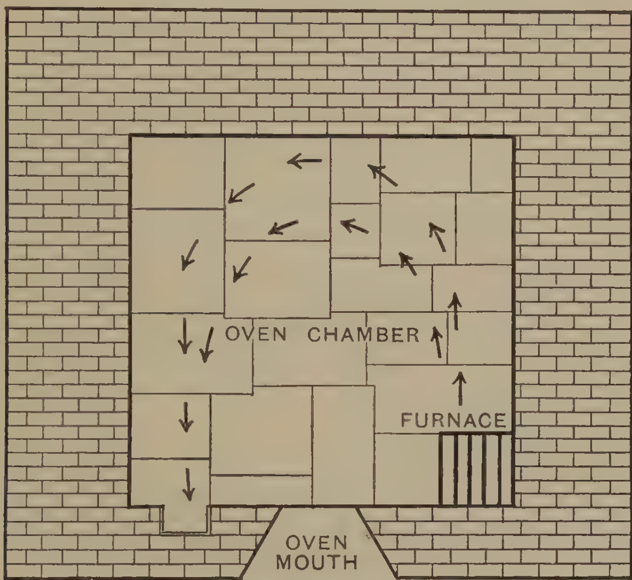


Fig. 194.—Plan of Modern Scotch Oven

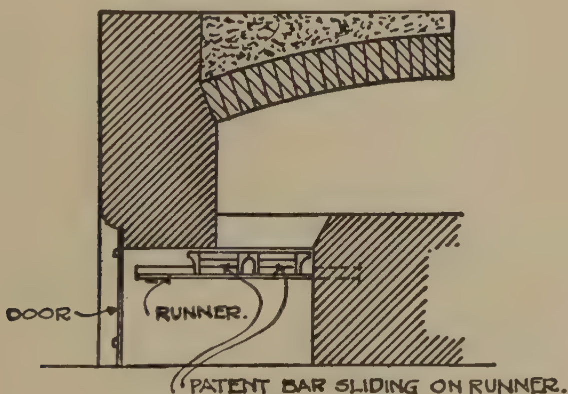


Fig. 195.—Crossby Sliding Furnace

that still in use in the modern Scotch oven. A proper flue is built in the front wall of the oven in a position opposite to the side in which the furnace is placed (fig. 194), and this is controlled by a damper exactly in the same way as a side-flue oven. When the oven door, which is now usually swung on hinges in the orthodox way, is shut, and the ashpit door is open, the coke fire soon burns to a white heat, and the crown and walls can be

heated to high intensity when necessary for "flash" purposes. But the Scotch oven is still essentially a solid structure, and on account of the close-packed bread baked in it its heat must also be solid; that is, it must not be so much a surface heat as a sort of heat reservoir in which a great *quantity* of heat is stored. To ensure this the heating process has to be done slowly. The usual practice is to pile on a considerable quantity of coke on the top of a small, bright fire after the usual work of the day is done, and by leaving the ashpit door a very little open, and the damper also open about an inch, to keep this fire burning very slowly all night.

Management of the Scotch Oven.

With the heat generated in producing the first bright fire by blowing, this slow combustion of the coke has been sufficient to saturate—if the word may be used in this sense—the crown, walls, and sole with a large *quantity* of heat. At the beginning of the day's work the fire will be still alight, but the greater part of the fuel burned away, leaving a clinker consisting of the incombustible mineral matter of the fuel. This clinker is first removed, the live part of the fire raked together and freed from dust through the ashpit, then a few shovelfuls of coke are thrown on, and the fire allowed to blow for about twenty minutes for the purpose of giving the intense surface heat needed; then the oven is ready for the day's work. Fig. 195 shows a movable furnace to make easy the work of clearing the fire or removing clinker. If a batch of bread is the first thing to be baked in the oven, it may be necessary to allow it to "lie down" a little before setting of bread commences, so that the intense surface heat may penetrate into the solid material of the oven.

The modern Scotch oven is still a very high-roofed structure, about 2 ft. 10 in. in the centre of the crown being the usual height. Amongst

Heat Capacity of the Scotch Oven.

its virtues may be mentioned the capacity it has for absorbing and retaining heat. The heat-retaining properties of the oven crown are much assisted by its formation. It is an essential feature that the spring of the arch is some distance above the top of the oven door, so that even if the oven door is open, the highest heated air in contact with the oven crown will not descend to the height of the top of the door to fly out. The part of the oven above the level of the door, therefore, forms a kind of closed box of more or less stagnant but extremely hot air, which protects the crown from access of cold air without hindering radiation. Some oven-builders intensify this effect by keeping the top of the oven flue, through which the products of combustion emerge when the fire is burning, about the same height as the top of the oven door, so that these products have to descend a little before they reach the level of the exit. This arrangement, while it slightly reduces the draught, is one making for economy. The hot products, on which the heat of the oven partly depends, have more time to be absorbed, and the level of the crown being above the level of the exit, these products are likely to pass up the chimney at a lower temperature than in the case where the opening to the flue is nearly continuous with the crown. The slight reduction in draught is due to the partial obstruction which the part

of the wall above the flue presents to the highly heated currents from the fire as they rush along the roof of the oven to the flue, but partly also to the reduced temperature of these currents when they do pass up the chimney. Fig. 194 (see p. 7) shows the direction of the products of combustion in an oven of this class. On account of the height of the crown it is possible to keep a small coke fire burning very gently even while the bread is baking. Active combustion is not allowed during that time, but the fire is kept alight, and as a rule some damp coke is thrown on it before setting commences, and the ashpit door kept closed, so that not more air is allowed than enters, virtually, above the fire, by the oven door. This arrangement keeps the fire burning without producing any appreciable quantity of fumes. The purpose is to allow a flash heat to be given the oven between batches if necessary; or it is not uncommon to allow the oven to "blow" for some time, that is, to allow the fire to brighten up while, say, the last batch is in the oven, if it is desired to secure a better colour and bloom on the top crust than the oven in its comparatively cold state would give. This plan is quite safe in an oven with such a high crown, and in which the opening to the flue is considerably above the top of the baking bread, for the products of combustion with such an arrangement need not reach the top of the loaves, the bloom and colour on the latter being really obtained by radiant heat from the newly and intensely heated crown. Those who fear to lose the steam in an oven while bread is baking will regard the method of obtaining bloom just described as very strange, but if it is considered that the expedient is only adopted in a case when the oven is very cold, and therefore in circumstances under which the bread has probably not lost the normal quantity of moisture, and when it is remembered also that the reduction of moisture in a loaf to a definite extent is an essential condition of its being properly baked, the strangeness of the method disappears. The conditions under which Scotch loaves are baked also prevent undue drying, as the top crusts of the loaves are nearly continuous, and the crumb is but little exposed to excessive evaporation, even under the conditions mentioned. It is not possible to actually heat the crown of an internally heated oven while the bread is baking if the crown is low, as in the side-flue oven, yet, other things being equal, it is not a bad plan to complete the baking of a batch of bread in a perfectly dry heat—that is, in an atmosphere quite free from steam. Leaks in the oven structure or in the door fittings may prevent the atmosphere within the oven being quite steam-saturated, but when it is even nearly so the effect is to toughen the crust of the bread after it has cooled, whereas, if the last four or five minutes' baking takes place in a steam-free atmosphere, the crust is rendered crisp and retains this property.

The greater part of the heat in the sole of a Scotch oven is obtained by conduction directly from the fire, the heat passing through the stones from one particle to another outward from the furnace. On this account the stones around the furnace are much hotter than those away from it,

and the differences in this respect are so pronounced that more care is needed in baking small goods in this type of oven than in any other, to ensure anything like regularity; the systematic turning of baking sheets while the goods are baking is a necessity.

Source of Heat in the Scotch Oven.

The crown of the oven, like that of other types of internally heated ovens, secures its heat by convection currents of heated products or by flame from the fire, while the surface heat of the sole is in part obtained by radiation from the crown after that is heated. This latter source of heat to the sole is, however, much less effective in the case of a Scotch oven than in a low crowned side flue oven, because of the much greater height of the crown of the former. It may be interesting to note here the effect that distance has on the value of radiant heat from any source. Stated in a scientific manner, it has been proved that radiant heat—or, as it is called, radiant energy—is modified in its effects *inversely as the square of the distance from the source of the heat.* The meaning of this in common language, as applied to the heating effects of the oven crown at the oven bottom, is that if two crowns were heated to exactly the same intensity, but one was twice as far from the oven bottom as the other, the value of the radiant heat from the higher crown in a given time would not, as one might ordinarily expect be half that of the low-crown one, but would be only one-quarter. Similarly, if one crown were three times the height of another, and both were heated to the same intensity, the radiant heat from the higher one in a given time would only be one-ninth that of the lower. It will thus be seen that to get the same baking capacity from a high-crown oven as from a low one, the former needs to be heated to a much greater degree. Yet, as already indicated, the high roof and other peculiarities of structure in the Scotch oven are conducive to heat-retention, which is one of the properties specially desirable in an oven used for closely packed bread that requires long baking.

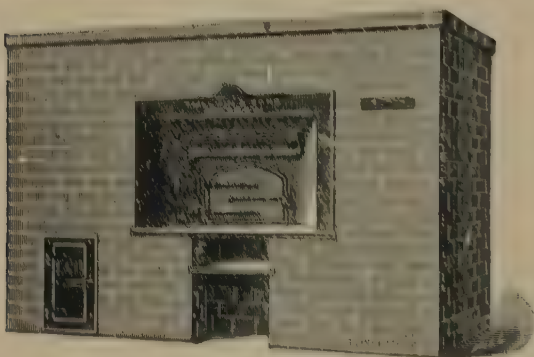


Fig. 196.—Scotch Oven Front

It is a curious fact that the very high-crowned Scotch oven is not well suited for baking the English type of loaf called a cottage; it makes them high, and in the case of many of the loaves nearly separates the tops from the bottoms. The baker generally gets over the difficulty of explaining this by saying that the high crown "draws" or pulls the tops off, but there is no reasonable explanation ever offered as to *why* this should happen, or by what means the "drawing" is effected. The probability is that the cause of the trouble

Cottage Loaves in a Scotch Oven.

is the extreme dryness of the atmosphere of the high-crown oven for a very considerable time after the loaves are set in it, owing to its large cubic capacity. The dry heat radiated from the crown causes a hard and inflexible crust to form very quickly after the loaves are set, much more quickly than would happen in an oven with the same heat in a moist atmosphere. The hard crust is formed before the interior crumb stops growing, and as the crust will not yield, the top is lifted from its position all in one piece. In an oven with a low crown, and therefore of much less cubic capacity, the steam from the baking bread very quickly, after the door is shut, fills the oven atmosphere with moisture to a degree at least to prevent the crust from becoming too rigid before the interior has stopped growing.

Advantages and Disadvantages of the Scotch Oven.

The general excellences of the Scotch type of oven consist in its great work capacity, small fuel requirements, and its longevity and low cost for repairs. Some of its defects, from a modern and universal point of view, have been pointed out, but its worst fault is the dust and dirt inseparable from its use. When the fuel has to be thrown on the fire through the same aperture as that through which the bread is set, and when ashes and fire have to be withdrawn through the same door, a great deal of dust is necessarily raised. To get over one difficulty, several patents have been granted for firebars that can be tilted, so that when necessary the fire or ashes can be withdrawn through the ashpit door instead of in the usual way (p. 7) through the oven door. The writer has had some personal experience of this arrangement, and can vouch for its efficiency as an improvement. There have been ovens of the Scotch type erected with furnaces like those of the side-flue oven, situated in the oven front wall, but the difficulty attending the use of such furnaces is that the thick oven sole does not get heated to anything like the intensity required, because the wall furnace does not heat the sole in the same way, by conduction, as a furnace continuous with the sole, and in close contact with it on two sides; then the wall furnaces, as constructed, were not suitable for burning coke, and with that fuel the back of the oven could hardly be heated. There is no reason, however, why the furnace of a Scotch oven should not be readily fed with fuel through the front wall, by a special passage which could be properly closed, while the fire is burning, by a hinged fire block swung behind and above the fire. One peculiarity of the method of coke combustion in a Scotch oven will be referred to in the chapter on fuel.

Side-flue Ovens.

In the south and midlands of England, and in Ireland and some parts of Scotland, the old pot ovens were succeeded by the type we now know as the "side-flue". The position of the furnace and flue and direction of the currents in this oven are shown in the plan, fig. 197, while the direction of the products of combustion when the fire is burning is shown in the section, fig. 198. The furnace is comparatively long and narrow, and is built in a slanting direction in the front wall. In some cases the roof of the furnace is sloped very slightly upwards so as to

run continuous with the crown of the oven. Sometimes the furnace bars are quite level, but in other cases they are made to dip a little towards the interior of the oven. The top of the flue is usually continuous with the oven crown, and the flue opening is nearly as deep as the interior wall

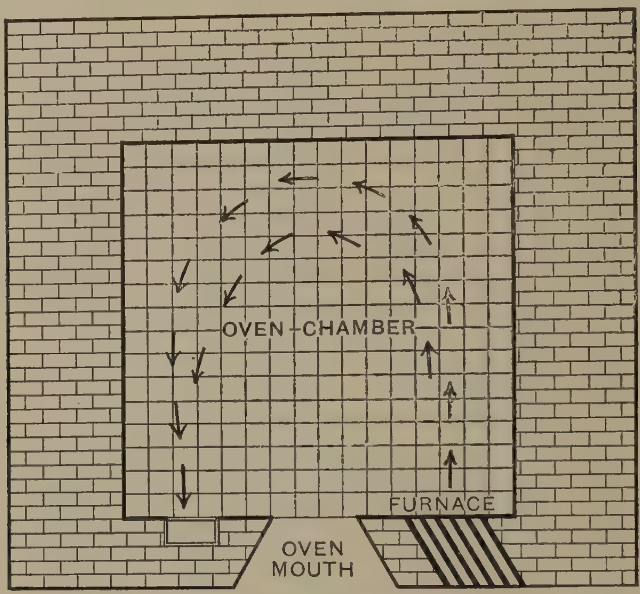


Fig. 197.—Plan of Side-flue Oven

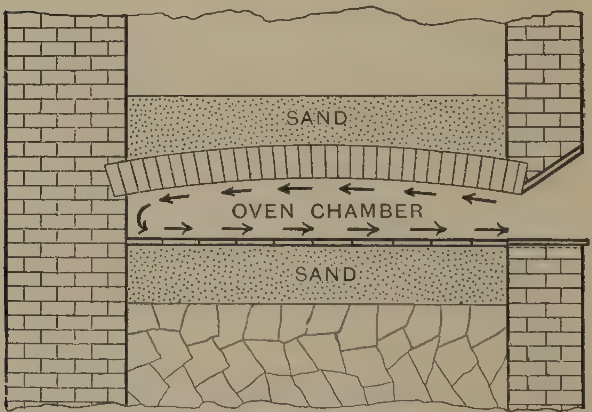


Fig. 198.—Section of Side-flue Oven

of the oven. The bottom of the flue opening is on occasions raised the thickness of a tile above the level of the oven bottom. The fuel almost universally used is coal, as a long flame is necessary to the effective heating of the oven. When the fire is burning, the oven door is shut and the flue, damper, and ashpit doors open. As the coal is freshly burning a long flame stretches from the furnace diagonally across the oven and spreads

itself out in fan-like form. As this flame is in closest contact with the roof the latter becomes intensely hot, and gradually gets to a white heat, through all adhering matter being burned off, and on account of the intense heat of the brickwork. When the oven is all clean and white the firing is considered sufficient, and no more fuel is used. The whole process of heating an oven of this type for the day's work may not occupy more than from two to three hours, according to the kind and quantity of baking to be done. Economy of fuel depends very much on the ovensman. A careless or uninformed man may readily use a large amount of fuel without obtaining anything like the equivalent heat from it. The most wasteful custom is that of allowing the fire to burn into holes, or to burn very low before adding fresh fuel. When holes are allowed in the fire the inrush of cold air through these is greater than is needed by the burning fuel, or at least it does not combine with the fuel, but serves to reduce materially the temperature of the actual products of combustion; in some cases when the fire is "green" the heat may be actually below the ignition point of the gases produced, the result being that there is much smoke and little heat, the combustible gases passing up the chimney unconsumed. When the fire is allowed to burn too low before fresh fuel is added the cold air entering under the grate is likely to be greater than the fuel can combine with; the products of combustion are therefore seriously reduced in temperature, and may even be at a lower temperature than the hot brick surface of the oven on which they impinge; that surface is therefore cooled instead of being heated. Most bakers are familiar with this sort of thing, and speak of the oven "blowing cold". Alternate heating and cooling of the oven due to such causes as just described are extremely wasteful. There is another trouble that sometimes arises through inexperience or carelessness. The experienced ovensman when about to add a fresh charge of fuel is careful to first push part of the white-hot coke left from a former charge of coal, after all the gas has been driven out of it, well towards the head of the furnace, and to place the fresh charge behind it and nearer the door, taking care, however, to leave enough bright fire underneath to light the new fuel. As the gas is driven out of the new fuel it is ignited as it passes over the white-hot coke at the head of the furnace, and none of the gases are allowed to pass away unconsumed, while the longest and hottest flame possible is produced by this means. The inexperienced man may throw his fresh fuel to the back of the furnace, and in consequence much of its products may pass up the chimney wastefully as smoke. In a side-flue oven when the gases are burned out of the coal, and the fuel is in the condition of coke, the oven cannot be readily heated by radiation from the white-hot coke owing to the comparatively small aperture of the furnace, but by convection the products of the burning of this coke convey the heat to the surface of the oven.

Reference has already been made to the heating effects on the oven sole of the radiant heat from the highly heated crown. This is probably one of the most effective sources of heat in the case of the side-flue oven. The

crown is very near the sole, and it is heated up by the contact of flame to almost a white heat, in which condition it radiates a great quantity of its heat to the sole. The heat in a side-flue oven is intense but essentially superficial. It is produced in a very strong draught in a short time, and from the burning of as much fuel as, or more fuel than, would be required to heat more "solidly" an oven of equal size of the Scotch type. After the oven is "clear", which is the sign that it is sufficiently heated, it is much too hot on the crown for baking bread, or indeed for goods of any kind, and in consequence a stated time, say half an hour, is allowed for the oven to "lie down", so that the excessive heat may be absorbed further into the interior of the oven material, from which again it may be paid out in a steady stream during the course of the day's work. But as this type of oven is easily and quickly heated so it is also easily cooled. The cooling is accelerated by the manner in which the crown is usually built. There is no ledge between the top of the door in most cases and the spring of the arch, but the open door almost exposes the oven for its full height except the very small curve of the arch. In consequence of this every time the door is open the hot air, right up to the crown, rushes out, and cold air from outside rushes along the oven bottom to take its place. Some builders arch the crown very little and keep it low, and this has no doubt the effect of making the oven easily heated with the minimum quantity of fuel and of obtaining the maximum value of the heat in the baking chamber, but, as just indicated, it also facilitates loss of heat every time the door is open. There is a limit to the flatness of an oven crown, and in any case the less arched it is the greater is the strain on the oven walls. The writer is familiar with a case in which a number of ovens were built with perfectly flat crowns. Steel ⊥ girders were placed transversely across the oven, and between these beams stones similar to those forming the sole were fixed. The oven was then simply a flat stone box with iron plates running across the top. The experiment was a total failure. The fuel used was coke, but no appreciable draught could be obtained, partly because of the flat roof and partly because the draught was intercepted about every foot by the thickness of the projecting iron plates. The hot gases from the coke fire necessarily tended to make their way along the crown, but the series of projecting plates, although not more than $\frac{3}{4}$ in. deep, were sufficient to direct the currents momentarily downwards, and their progress was therefore arrested by the eddies thus produced.

Heating in Side-flue Oven.

Flat-crowned Ovens.

Side-flue ovens, to those familiar with them, are economical and efficient, and they are particularly suitable for baking crusty bread and for small goods after the bread is baked. When an oven of this type is in use for a mixed trade the usual practice is to give the oven a second fire after the bread is baked, but only a small one is needed. The greatest defect in this type of oven is that it is in no sense continuous. Between every two batches it requires more firing, thus breaking the continuity of the work. A Scotch

Advantages and Disadvantages of Side-flue Ovens.

oven, on the other hand, is capable of baking at least three or at a pinch four batches of close-packed bread without any stoppage for firing between; and as these batches require from 1½ to 2 hours each to bake, the same quantity of heat would be capable of baking five or six batches of crusty bread which take from 40 to 45 minutes each.

Use of Coke in Side-Flue Ovens.

Many attempts have been made to adapt side-flue ovens for burning coke. This has been successfully accomplished, but only by adopting measures suitable for coke-burning. It may be regarded as impossible without a forced draught to heat a side-flue or any sort of oven with coke from start to finish, in the short time required to heat a side-flue with flaming coal. When it is considered expe-

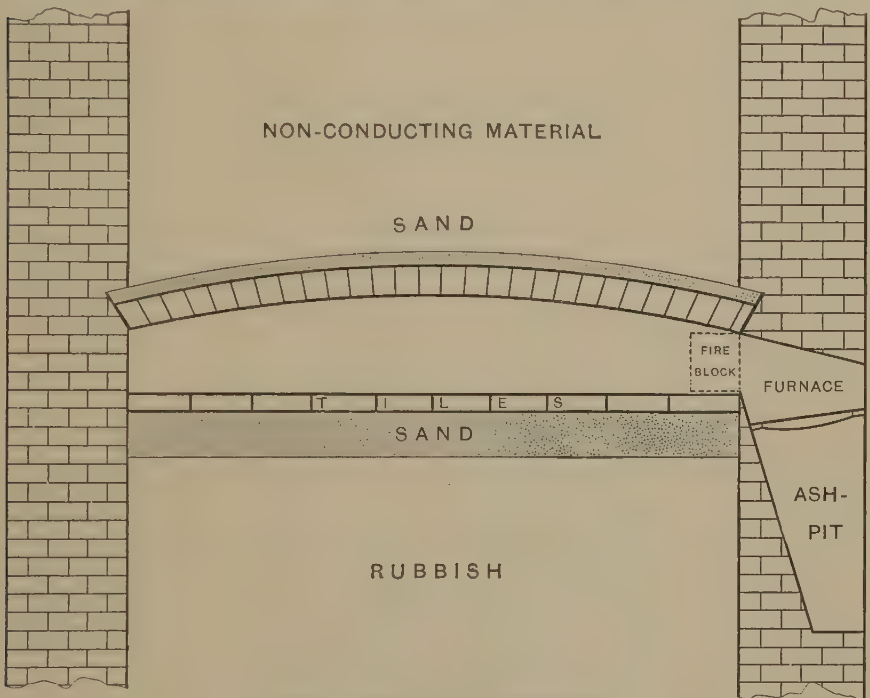


Fig. 199.—Section of Oven through Furnace

dient to use coke as the fuel in a side-flue oven the furnace needs to be enlarged, not because coke requires more space in which to burn, but because it is necessary to burn a comparatively large fire very slowly in the same way as in a Scotch oven, and the ordinary side-flue furnace is not large enough to contain a fire that will keep alight for the length of time. The most efficient way of altering the furnace is to lower the bars about 3 inches, and allow them to dip slightly towards the interior of the oven. This makes the furnace a little larger at the bridge than at the door. In addition the top of the furnace should be sloped upwards so that it forms a continuous line with the oven crown. Double doors on the furnace in the usual way, and a fire block cased in iron, and hinged so as

to cover the mouth of the furnace in the oven, complete the necessary alterations. This fire block in the iron frame may be hung either from the top or the side, but in either case it must be fully open when the fire is burning, and a recess must be made into which it fits when open. The purpose of this fire block is to shut off the furnace completely from the oven chamber when the bread or other goods are being baked. In an oven with a furnace so constructed the mode of firing may then be exactly similar to that described for a Scotch oven. After the day's work is done a good bright coke fire is produced by blowing the oven for about fifteen minutes in the usual way; then the furnace is heaped up with fresh coke and the oven shut up, except that the ashpit door is left open about half an inch to admit enough air to keep the fire alight, and the damper kept open very slightly to carry off the fumes generated by the slow combustion. In the morning or at the beginning of the day's work the clinker is removed from the furnace *after* the fire has been blown till it is bright; then about five shovelfuls of coke are thrown on, and the fire blown for about half an hour or less according to the kind of work to be done. The large all-night fire gradually compensates for the heat that was used in the previous day's baking, and raises the whole of the materials of the oven to a sound baking temperature. The shorter sharp fire in the morning gives the necessary surface intensity to supply the bloom on bread or small goods baked. It is then that the use of the fire-block stop comes in. It is turned down and the furnace effectively shut off from the baking chamber, but the fire in the furnace is still alight and must be kept so, as this type of oven cannot be heated to the same "solidity" as one of the Scotch type, and it is necessary to supply a flash heat between the batches. It would be quite ineffective to relight a coke fire on each such occasion; hence the need for keeping a bright fire ready for use immediately it is required. To this end the furnace is provided with another damper not connected with the oven chamber, and while the furnace block is down during baking this damper is open slightly to take away the fumes if the fire is intended only to burn very slowly, or it may be opened full while a batch is drawing to get the fire up to a high degree of brightness, so that it may be turned into the oven at once by raising the block as soon as the oven is empty. Worked in this way, and with furnace fittings of this description, there is no difficulty in using coke or anthracite coal in a furnace or side-flue oven, and the arrangement effects a considerable saving in fuel.

The description of internally heated ovens already given nearly exhausts the types of this sort with which we are familiar in Britain.

Austrian Oven.

In Austria there is an internally heated type used both for plain bread and fancy rolls in which the furnace bars are placed directly in front of the oven door. The bars are sunk about an inch under the surface of the oven bottom. The fuel used may be either coke or wood faggots. There are one or more flues fixed at the head of the oven, so that the heat may be directed to one side or the other as desired by opening either damper. The fuel is heaped up as in an ordinary fire on this

flat grid and allowed to burn, the draught being supplied in the usual way through the ashpit. When the oven is sufficiently heated the bars can be tilted and the ashes tipped into the ashpit, all the ashes scattered in the oven being drawn into the same receptacle. The sunk grid is then covered with a thick iron plate, which, when in position, is flush with the oven bottom. The peel, in setting the bread, slides back and forward over this plate, which is really indistinguishable from the oven bottom. This seems a rather ingenious way of heating an oven, and for the low calorific value of the fuel used it seems efficient and economical. Some of the ovens of this type are round internally while some are of the usual oblong shape. The ovens, except for the ashpit, are built quite solid with thick tile bottoms. A point of some interest in their construction is that the part under the tile sole is filled wholly with loose dry gravel, the purpose being to conserve the heat of the bottom as much as possible, and to this end gravel is really more effective than solid material, the air spaces between the small stones acting as better non-conductors than even the solid material of the gravel. Loose filling of this kind is cheaper, and does not expand with heat as may solidly built material when that is used for filling.

The ovens hitherto noticed have all been of a perfectly simple kind, internally heated, and with only one damper to regulate the fire, although a small steam damper is a common fitting, even in such ovens, to let off the steam before starting to draw the bread. There is nothing complicated about the building of such ovens and little difficulty in their working, and there are no patents involved in their construction. They can readily be built by an ordinary bricklayer under the direction of the baker. Externally heated ovens are for the most part proprietary structures involving special features patented by their respective builders. The simplest of such ovens consists essentially of a brick or tile chamber, under the bottom and over the top of which a series of flues communicating with the fire at the back of the oven are conducted. The top of the bottom set of flues is usually built of fire blocks to withstand the great heat of the combustion products as they first leave the furnace. These flues can all be regulated together by a single damper fixed in the chimney, or each flue can be regulated by a separate damper so placed in its passage as to increase the top or the bottom heat at will or to direct the heat to particular parts of the oven. The fuel used in ovens of this type may be either coal or coke, although the latter is in more general use. This type of oven is another example of a case in which it is advantageous to burn the coke at two stages—that is, first to produce carbonic oxide in the furnace, and then to burn that in a long blue flame in the first section of the flues into carbon dioxide (CO_2). The total heat is the same as if the coke were properly burned at once in the furnace to CO_2, but the flame of CO in the flues carries forward the point of maximum heat a good distance from the furnace, and therefore provides a better opportunity for the top flues to get their full quota of heat than if the heat maximum were in the furnace itself.

Externally Heated Ovens.

Advantages and Disadvantages of Externally Heated Ovens.

There is very great variation in the efficiency of externally heated ovens. Unless the flues are carefully built and of first-class material there is a constant danger of parts collapsing, as they are burned out, and choking up the passage. As the flues need to be periodically cleaned out from soot, boxes are conveniently built in for the purpose, and as this may be roughly done by a careless man, another opportunity is afforded of either choking up the flues by pushing the soot into the bends and corners, or by actually disturbing or breaking the brickwork of the oven. Other disadvantages attending the use of the ordinary externally heated oven are the difficulty of getting up the heat of the oven chamber quickly if it has been allowed to cool unduly, and the further difficulty of cooling the interior rapidly if it should be overheated, as the heat is necessarily solid. The hollowness surrounding the oven chamber increases the liability to the formation of cracks in that chamber, with the consequent loss of heat and loss of steam while the baking is proceeding. The quantity of fuel needed in an oven of this type is greater than in one heated internally. The advantages pertaining to these ovens are the comparative cleanness of the oven chamber and the absence of ashes, dust, and excessive heat from the furnace, within the bakery. Then the ovens are practically continuous, because the fire can be kept going while the bread is baking, and so batch after batch can be baked without stopping. This saving of time enormously increases the capacity of the oven over the ordinary side-flue type.

Hot-air Ovens.

External-flue ovens, generally referred to as hot-air ovens, have been largely adopted in the south and west of England and in the Midlands, but have not found great favour in Ireland or Scotland. An oven of this type, but modified to get rid of some of the disadvantages referred to, was designed and patented a few years ago in Scotland, and has met with a fair measure of success. This oven, called Scott & Richards' "Peeler" oven, is adapted for either close-packed or crusty bread, or for small goods, and may be built for peel use or as a drawplate. By an ingenious arrangement of dampers it is possible to direct the heat from the furnace directly into the interior of the oven, and so provide an intense "flash" or surface heat at will. When the oven is very hot and goods requiring a cold oven are to be baked it can be cooled down very rapidly. The writer had an opportunity of working with this oven under circumstances disadvantageous to the oven—it had been built less than a week—yet it was thoroughly efficient to bake both crumby and crusty bread, and by the use of the various dampers already mentioned, lighter goods than bread were baked before and after the batches. The oven also showed a most favourable record in consumption of fuel.

Baker's Patent Oven.

Amongst externally heated ovens one of the best known is that called the Baker's Patent (fig. 200). In this oven the flues are external to the oven chamber, but to obviate the difficulty of supplying a flash heat when necessary the actual flame from the furnace can be directed into the oven chamber. This oven has therefore the advantages

of the cleanness and continuity of the externally heated oven with the adaptability of the side-flue oven for getting up an intense surface heat when required. To ensure a comparatively moist atmosphere in the oven, when desired, iron channels are sometimes built in the side walls in the

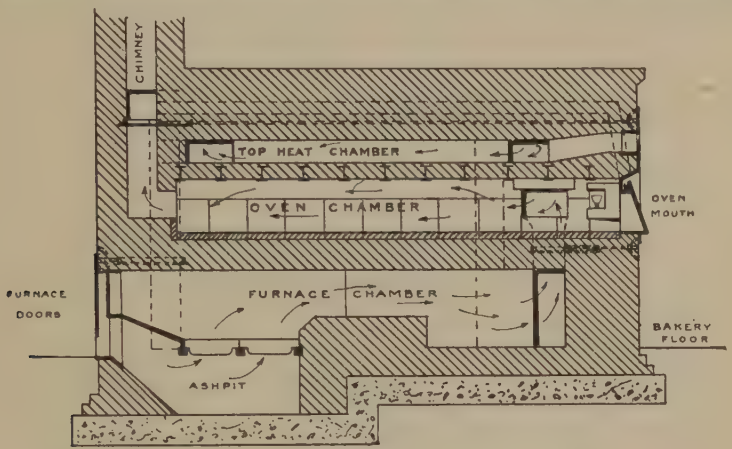


Fig. 200.—Section of Hot-air Peel Oven (fired at back)

oven along which a quantity of water can be directed at will. Those familiar with this type of oven speak highly of its continuous baking properties, and of the small quantity of coke needed for its heating. But it is an oven that needs to be managed with care; otherwise the adaptability to emergencies which the several dampers make possible may

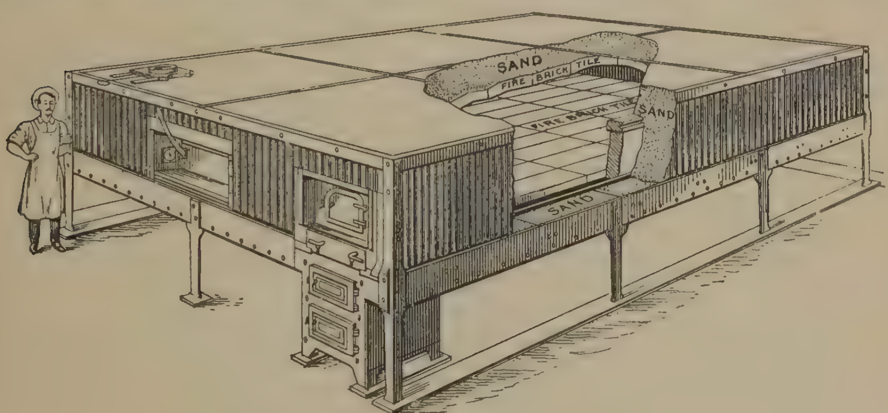


Fig. 201.—Typical American Oven of Flue Type

readily be a disadvantage for the single purpose, say, of breadmaking. This oven is now in use so extensively in peel and drawplate forms that its reputation is firmly established.

These externally heated or hot-air ovens belong essentially to the class of chamber ovens. These may be defined as those in which the products

of combustion do not enter the oven chamber (exceptions have already been noted), the oven chamber being really a highly heated brick or iron box. There are, however, two distinctive

Chamber Ovens.

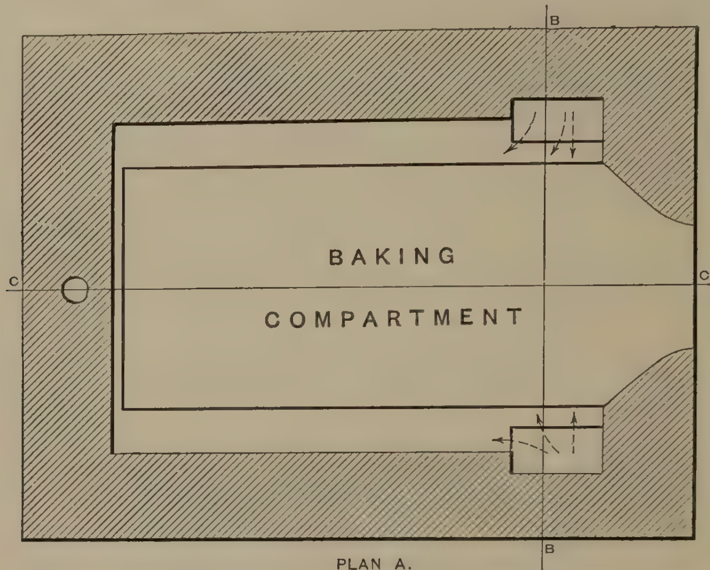


Fig. 202.—Cox's Heat Trap Oven: Plan A A (see fig. 204)

types of ovens in use in this country that better deserve to be called chamber ovens, as in both types the baking compartment is within a large brick chamber highly heated externally. The ovens referred to are that known as *Cox's Heat Trap Oven*, and the mechanical type called the *Reel Oven*. The first mentioned consists of a large brick chamber (figs. 202–204), underneath one side of which there is a comparatively small furnace to burn coke. This furnace has communication with the chamber already referred to by flues running under it and upwards through flues in its four corners. The products of combustion therefore enter this chamber at the top, but cannot find egress to the chimney until they descend to the bottom, for the opening of the flues

Heat Trap Oven.

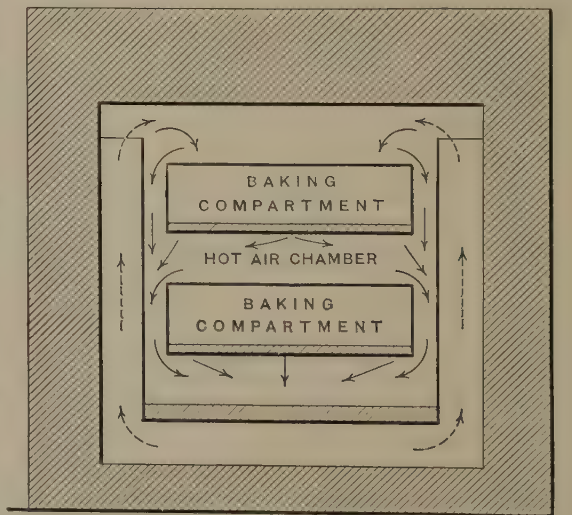


Fig. 203.—Cox's Heat Trap Oven: Section B B (see fig. 202)

to the chimney—of which there are four at the sides—have their open ends near the bottom of the large chamber. The effect of this arrangement is to make the highly heated products of combustion descend to the bottom, parting with their heat gradually on the way. The baking chambers consist of iron flat boxes suspended or fixed within the heated chamber referred to. The atmosphere of the latter being highly heated, quickly by conduction passes this heat through the sheet iron to the interior of the baking chambers or boxes. The theory is that the heat in the large chamber should be alike throughout, but in practice it does vary slightly, and the variation is in the opposite direction to that shown in the ordinary

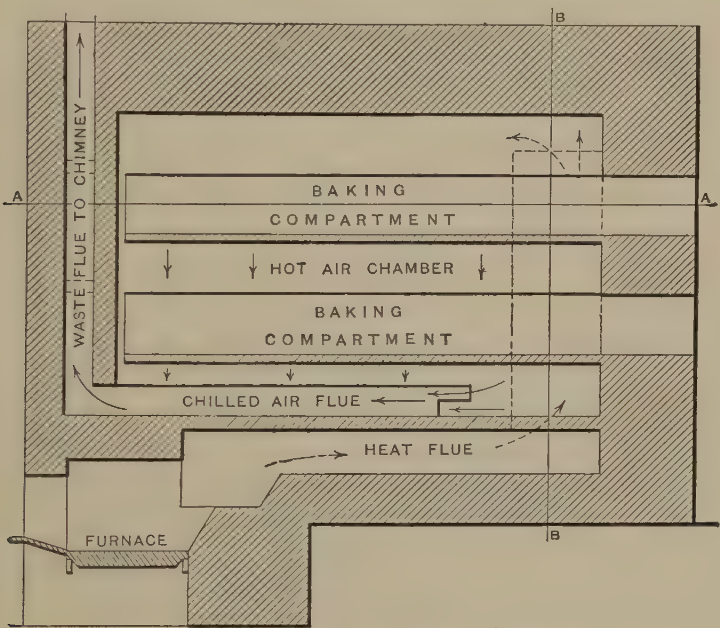


Fig. 204.—Cox's Heat Trap Oven: Section CC (see fig. 202)

type of decker oven; the top oven in this case, if there are two or three, one above the other, is hotter than the bottom one. The baking chamber is quite flat in each case, and has no direct opening into the hot chamber in which it is fixed. The heat throughout the oven, with the slight exception referred to, is therefore alike, and the writer is informed by those who are habitually using this type of oven that the loaves or other goods are baked with great regularity. The most advantageous point about the appliance is its economy of fuel. The arrangement of flues is conducive to a very slow draught in consequence of the drawing flues having their openings at the bottom of the heating chamber. The descent of hot air is naturally a slow process, so that when it gets to the chimney it is likely to be comparatively cool, much cooler at any rate than the hot air in the chimney of a side-flue oven. This reduces the speed of the draught in the former. But it is

Economy of Fuel.

quite evident that if a slow-burning coke fire can be made to supply all the heat necessary to bake batch after batch of bread or other goods, then a given weight of coke in such a furnace is likely to last longer than one in which the draught is quick, because the air in the chimney, after it has passed its work, is very hot. The products of combustion in this heat trap oven should part with the greater part of their heat in actually heating the baking chambers. The ovens are continuous. They can be built in tiers of two, three, or more, and for use with the peel or as drawplates. The writer has not personally used these ovens, but from trade friends he has received the assurance that the ovens are very efficient, and that in practice they faithfully bear out the claims made for them in the matter of low consumpt of fuel and fitness for steady work.

Reel Oven.

The other type of chamber oven alluded to is the reel oven (fig. 205). This oven is said to have been patented in America by a grocer named Adams who took up baking early in the last century. It is not subject now in Britain to any patent rights, and as a bread oven is much less used than it was some twenty to twenty-five years ago, but is still extensively used in American and Canadian bakeries, and has there been very much altered from the original form and brought quite up to date both in the matter of fuel and in the automatic attachments with which it is fitted. The essential points about a reel oven are: that it is a large brick or insulated iron chamber nearly square internally, with one or two furnaces underneath that have flues outside the back of the chamber. The products of combustion do not enter the baking chamber but are confined to the flues. In the baking chamber is an iron frame, between the sides of which iron shelves, about 2½ ft. deep, and with backs, are suspended. These shelves extend the full width of the oven. The oven door also extends the full width of the oven, like the door of the modern drawplate. The internal frame revolves, either by mechanical or hand power, while the bread is baking. It is only suitable for baking tin bread, although it has been largely used for biscuits. The shelves can be stopped exactly in front of the door to be filled or emptied. When all the shelves are full the frame is kept turning slowly but steadily for the full time the batch is baking, the purpose being, of course, to bake the bread on all the shelves alike, for otherwise those at the bottom of the oven and those near the flues would be much overbaked, and those near the front of the chamber would not be sufficiently baked. The revolving arrangement gets over

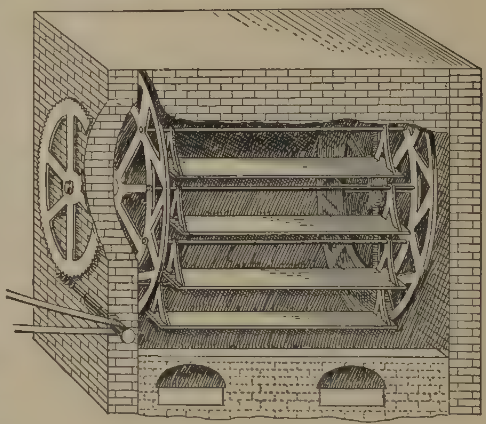


Fig. 205.—A Reel Oven

this difficulty in two ways: by assisting mechanically to equalize the temperature of the oven atmosphere, and by moving the loaves slowly through and out of the hottest parts just above the furnaces. This sort of oven is not economical for a small trade, but is an efficient and quick baker where there is a very large tin-bread trade done. The oven, however, was never in common use here, except in the large Glasgow factories, in one or two in London, and in two in Ireland. It has now been almost

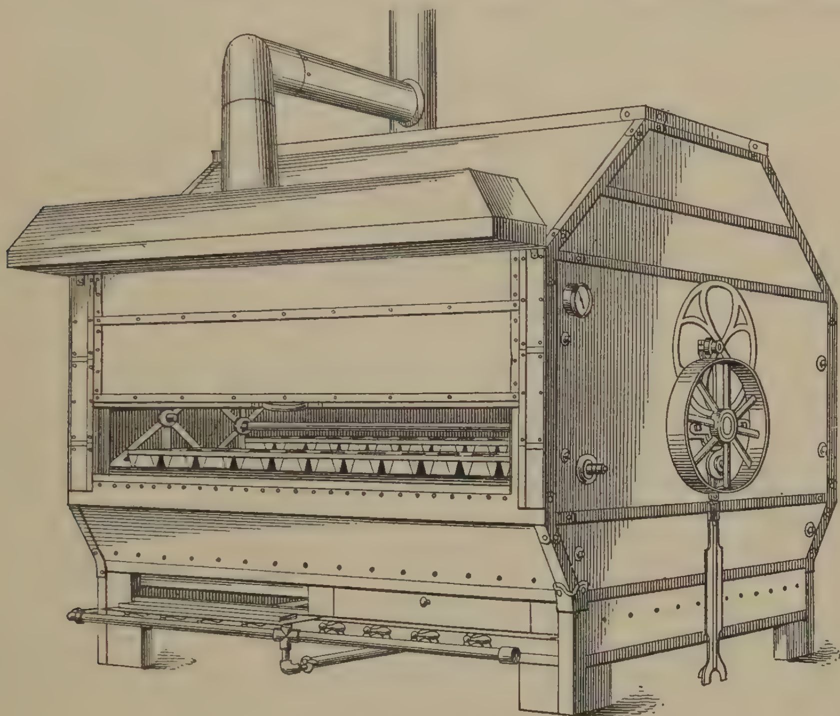


Fig. 206.—American Reel Oven

if not quite discarded. Its good points are its large capacity and economical working in factories where the machinery is always running. The faults that have caused its displacement are the great labour and excessive strain it imposed on the men in charge of it; the tendency to break down of some of the moving parts; or the accidental tipping of a shelf or of one or two tins, which would cause the stoppage of the whole machine and spoil a whole batch, as there was no means of getting out the loaves except by the door, and they had to remain till the oven had cooled.

Merits and Defects of Reel Oven.

This type of oven was introduced here directly from America, and in those bakeries where it was in use was generally referred to as the Yankee oven, but the originals were known in America as the "Boomerang" ovens. As noticed above, they are still extensively used there, and the latest development is to

"Yankee" or "Boomerang" Ovens.

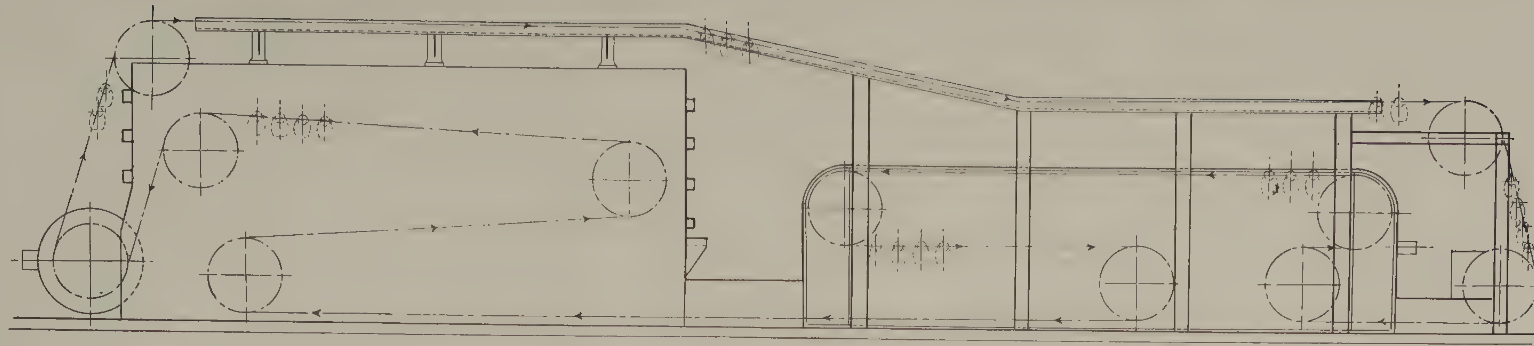
have the oven built on an iron frame, the two ends of which are Λ-shaped. The spindle of the movable frame has its ends in bosses at the apex of each Λ-shaped standard. The shelves are arranged in the same way as in the older type, but the door for filling is situated down near the bottom of the chamber; and in one patent oven there is a mechanical tipping arrangement with an opening in the bottom of the oven opposite to the filling door, by which the shelves, as they reach that arrangement after the bread is sufficiently baked, are tipped up, and the tins slid on to a flat trolley that automatically stops in position to receive them. Coal or coke as the heating agent is now discontinued, and producer gas (or ordinary) is being adopted. As this can be effectively burned in long series of burners under the ovens and cased in, no furnaces are needed, and on this account the ovens can be fixed on the logs some distance above the floor to allow the trolley already spoken of to run under the oven into position. An oven built on this system is in a large Toronto bakery, and is the patent of the proprietor. Fig. 206 shows one of the latest type of reel ovens heated by gas, as in use in several large bakeries in the United States.

Rotary Oven.

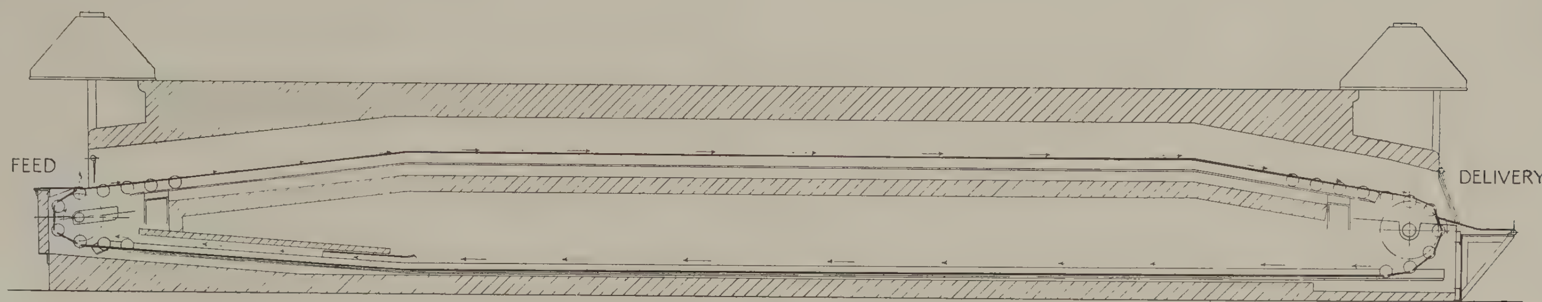
While on the subject of ovens with mechanical parts, it may be of interest to notice the round oven in which the sole is made to revolve to facilitate the setting of the bread, and which may also be turned from time to time while the bread is baking. This type has never, to the writer's knowledge, been in common use in Britain, but is still extensively used in Germany and Holland for ordinary bread-baking, and finds some favour also in the United States, probably amongst the foreign bakers, who almost dominate the baking trade there. Fig. 207 shows the parts of such an oven. This type is designated the "rotary oven", and also belongs to what has been called the chamber class.

Travelling Ovens.

Travelling ovens for bread have undergone great developments within the last few years. Messrs. Joseph Baker, Sons, & Perkins, Ltd., specialize in ovens of this type, and have built them in many of the largest American and British bakeries. For all sorts of crusty oven bottom bread the continuous plate oven is adapted; for pan bread only, a new type has been designed, called "The Swinging Tray Travelling Oven". The plate travelling oven for bread is on much the same lines as that for biscuits, and has an effective baking surface 9 ft. wide and 110 ft. long, that is, an area of about 1000 sq. ft. It is heated either on the steam-pipe system or with gas burners directly heating the baking chamber below and above. Where pan bread only is made, the pans can be filled automatically, and carried and set in the oven without handling. The swinging tray ovens can also be automatically filled with loaded pans. The combination of the swinging tray oven with an automatic final prover is shown in the Plate. The growing practice of wrapping bread has induced many bakery firms to install these ovens, and they are giving much satisfaction. The conveyor chains for "prover" and oven are in one continuous set, and after the baked bread emerges from the oven the empty tins are carried forward on the same



CONTINUOUS OVEN AND PROVER, SWINGING TRAY TYPE



TRAVELLING PLATE BREAD OVEN

conveyor and cooled, cleaned, greased, and refilled, then proved and again carried on through the oven. By an arrangement of gear the time of proof can be varied from twenty-five to forty minutes.

Steam-pipe Ovens.

Returning to methods of oven-heating, a few notes must now be given on the system that is really characteristic of our time, viz. heating by steam pipes. Even amongst bakers there is still much ignorance as to the principles by which steam is applied for this purpose. There are now many forms of steam-pipe ovens, with variations in the method by which the heat is applied, but all the systems agree in this particular, that the steam is enclosed in a steel or iron tube sealed at both

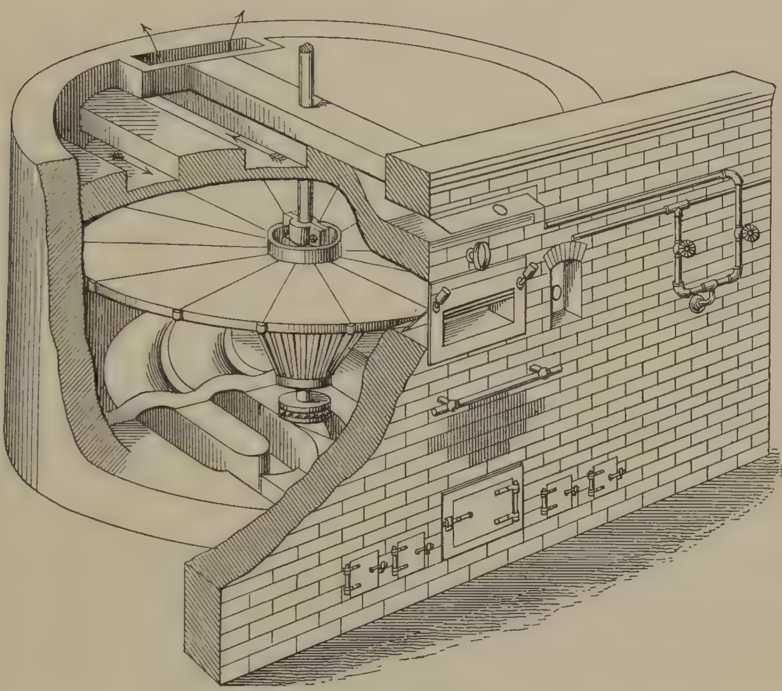


Fig. 207.—American Rotary Oven

ends, the steam never being allowed to escape unless the pipe or tube bursts. The tube, which may be straight or bent according to circumstances, may be about 10 or 12 ft. long, its solid walls about $\frac{3}{8}$ in. thick, and the bore or hole running through it about $\frac{1}{2}$ in. in diameter. In preparing the tube for an oven it is sealed at one end, and a quantity of water that has previously been freed from air by boiling is poured into it. The tube is filled to a little over one-third its total capacity, or in some cases it is filled about half its total length. The quantity of water actually in the tube may be from $1\frac{1}{2}$ to 2 pt. After filling, the open end of the tube is carefully welded. These pipes are built into the ovens so that they slope towards the furnace, the object being to ensure that the end actually in the furnace, or at least subjected to its intense heat, contains

water in the liquid state; otherwise the ends of the tubes would readily fuse and burst. The reason that water and steam are the agents or vehicles by which the heat is conveyed to the baking chamber is because water is the best heat-retaining liquid known. This, of course, also implies that it is the most difficult to heat up to any definite intensity; a given weight of it requires a greater quantity of heat to raise its temperature through a given number of degrees than the same weight of any other substance. This property of absorbing heat is called the specific heat of a substance, and water therefore is said to have a greater specific heat than any other substance. The quantity of heat which would raise a pound of water from 0° to 100° C. would be sufficient to raise a pound of iron from 0° to about 900° C., that is to a dull-red heat. It follows that in cooling down again from 100° to 0° C. the pound of water would give out as much heat as the pound of iron in cooling from 900° to 0° C. This is the reason that water is so suitable as a means of heating buildings and as a means of heating ovens. It explains why steam-pipe ovens have to be heated comparatively slowly. The water in the pipes is not wholly converted into steam, but mostly continues in the liquid state. As soon as it reaches the boiling condition a small portion is converted into steam, and as this cannot escape it produces great and increasing pressure on the water still remaining, so that the latter is not converted into steam.

High Specific Heat of Water.

It may be interesting here to state that the originator of the system, Mr. Perkins, whose descendants are still actively engaged in oven-building, was an eminent engineer, the author of many patent appliances relating to steam and hot water for heating purposes. It is stated that his main purpose in coming to this country from America was to put before the British Government an appliance called a water gun, which was to eject projectiles by the force of water heated to a high degree under great pressure. Amongst the bakers who originally assisted the inventor by experimenting with his ovens was Mr. Neville, the founder of the large London bakery firm. The steam-pipe oven as first arranged did not, as now, consist of rows of single pipes each independent of the other, but had series of pipes jointed together with screw couplings, so that the whole ovenful was virtually one pipe with many bends. As the pressure with highly heated water and steam was very great, the utmost trouble was occasioned by the joints leaking, and one expedient after another was tried to make the joints quite tight under pressure, but without success. Ultimately the plan was adopted of making the pipes in straight lengths with both ends sealed as at present.

Inventor of Steam-pipe Oven.

The original patent for the construction of steam-pipe ovens having expired, the principle has been adopted by nearly all oven-builders, some following the lines of the original builders, others adopting different methods of applying the same principles to the heating of ovens. The firm of Messrs. Baker, Sons, & Perkins, Ltd.,

Various Forms of Steam-pipe Oven.

who were the original firm of steam-pipe oven-builders, sometimes use the bottom row of tubes as the firebars; then, in the case of a peel oven, there is only one other row of pipes which supplies the heat to the top of the oven, but if the oven is of the drawplate type, then, besides the row under the fire, there is another row which projects a few inches into the furnace and above the fire but also under the drawplate. In these ovens, therefore, there are two rows of pipes under the plate and one to supply top heat. This extra heat under the plate in the case of a drawplate is to compensate for the loss of heat occasioned each time the plate is pulled out.

Theoretically it seems strange to make the ends of the bottom row of pipes as the furnace bars. Heat ascends, and it might be surmised that pipes under the fire would in consequence not become sufficiently heated, but in practice the close contact of the ends of the pipes with the fire compensates for the position *under* the fire and they become sufficiently heated. Two conditions determine how much or how little heat the ends of the pipes above the fire will obtain—namely, length of exposure and distance from the fire. The ends of pipes that project into the furnace directly above the fire are not exposed more than 1½ to 2 in. The whole efficiency of the oven, in fact, depends on whether the length of pipe is exposed just enough, or too little, or too much. If too little, the bottom heat of the oven may be less than enough; if too much, the bottom may have too much heat. A difference of half an inch in length of pipes exposed may make all the difference between efficiency and constant trouble with an oven either too hot or too cold. The row of pipes supplying top heat is some distance above the fire, and here again the length of pipe exposed determines whether the oven will have enough, too little, or too much heat on top. Remembering the principle already referred to, that radiant heat is inversely as the square of the distance from the source of heat, since these top pipes receive a good deal of heat by radiation, the closer they are to the fire the more heat they receive of this kind. In the steam-pipe oven under notice the top pipes are heated partly by convection — that is, by the hot products of combustion passing along and over them—and partly by radiation, so that it is the aim of the oven-builder to make these hot gases pass as slowly as possible over the pipes consistent with securing a sufficient draught to burn the fuel properly, and at the same time to adjust nicely the length of pipe exposed and the distance from the fire so that the pipes will not receive too much radiant heat to make the top of the oven too hot.

The section of the steam-pipe oven in fig. 208 represents a peel oven, and shows the manner in which the pipes are placed. To secure a slow draught a deadplate is in some cases fixed under the main damper, so that a limit is put to the width of the aperture through which the products of combustion can pass up the chimney whether the damper is pulled out to its full extent or not. This expedient had to be resorted to because of the weakness of ovensmen for

Use of Deadplate.

pulling out the damper to its fullest extent although it may not be necessary for the efficient burning of the fuel. With the fixed plate limiting the width of the aperture, the damper can only be used to reduce that width but not to increase it. Another expedient, the arrangement for which is also shown on the drawing, is to increase the bottom heat of the oven when necessary by shutting the damper, which stops the flow of air into the ashpit through the fire and up the flue, and directs this flow instead, in through the holes in the furnace doors, down through the fire, and along the ashpit to a flue at the side controlled by another damper. When this down draught is in use the ashpit door must, of course, be quite shut. Reference has been made to the influence of radiant heat in heating this kind of oven. The bottom row of tubes on which the fire rests are, of course, heated by conduction; the

Increasing Bottom Heat.

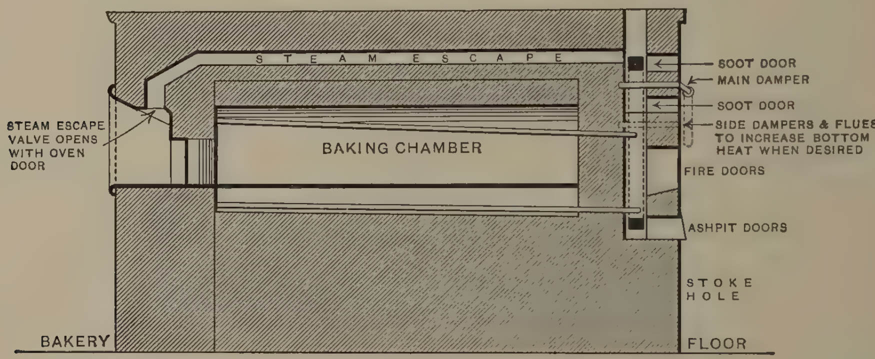
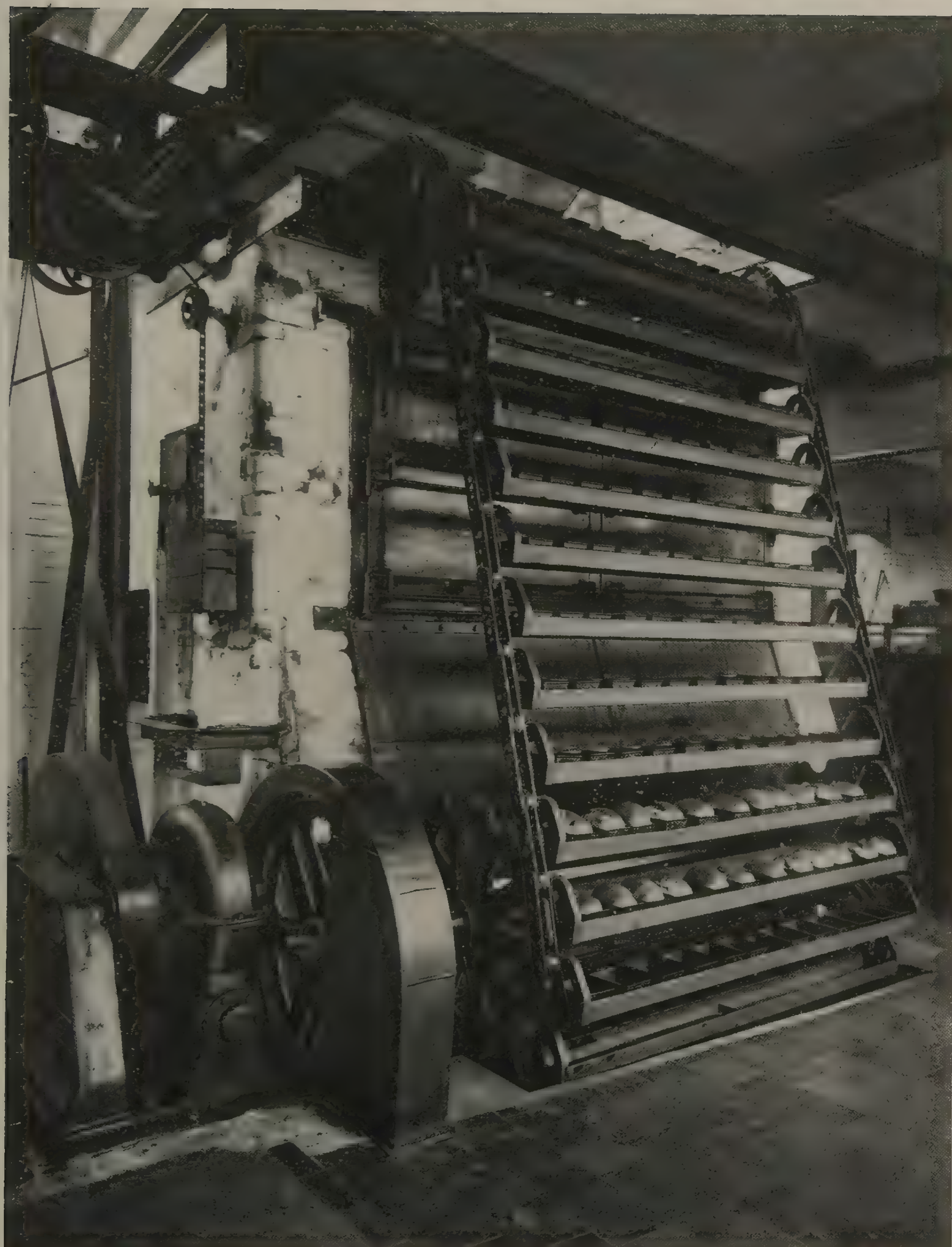


Fig. 208.—Section of Steam-pipe Oven

second row in a drawplate may be heated partly by conduction, by convection, and by radiation, according as the fire is large enough to touch them or not. The top row is heated, as already noticed, partly by convection and partly by radiation. The point is mentioned here to explain the reason for the instruction given for the heating of the ovens, that the fire should be kept comparatively small, or at least small enough to ensure that with the draught possible it can be raised to a white heat. When the fire is very large and heaped up it may become a bright-red only, with a flame of carbon-monoxide burning on top. The gases from a fire of this sort are very hot, and the currents of such gases passing along the top row of pipes heat them steadily, but such a fire does not give anything like the radiant heat of a much smaller fire in a state of incandescence—at a white heat. Yet radiant heat is a more effective and more economical agent for heating the pipes at a distance from the fire than convection currents. There is hardly any radiant heat obtained from the pale-blue carbon-monoxide flame on the top of a large fire. It is not to be understood that a very small fire should be maintained, but only that the fire should be no larger than the draught allowed will raise to a white heat.

Radiant Heat and the Carbon-Monoxide Flame.



94

AUTOMATIC PAN BREAD OVEN

The Firing of Steam-pipe Ovens.

In ovens of this type the furnace is very shallow but the full width of the oven. This form necessitates that the fire should always be spread very evenly; otherwise there is danger of one set of pipes being overheated and those in another part of the oven being much colder. In practice these variations may not be noticed, yet in the division between the two furnaces which constitute the full stretch of the oven some care is needed to keep that part of the fire as bright and clear as the part immediately in front of the furnace door. This is one of the very few troubles attending the effective heating of these ovens. In any case, however, the combustion is slow, and they cannot easily be heated in a hurry; but after heating they can bake steadily and evenly one batch after another if a steady fire is kept in the furnace, and about this there is no difficulty, since the furnace does not in any way communicate with the baking chamber. If the firing is done with regularity and care, this type of oven bakes bread and all sorts of goods with economy. It is necessary in this case, as in the majority of others, to arrange the order of the work to suit the condition of the oven, since the oven once cold cannot be quickly heated, and once hot cannot be quickly cooled.

Oven Temperatures.

There are a few peculiar points pertaining to steam-pipe ovens as a class that may be as well noticed at this point, although these peculiarities are not specially attached to the ovens under observation. Thus it is common knowledge amongst bakers using steam-pipe ovens that they do not always bake with the same degree of efficiency, although the temperature indicated by the thermometer may be alike when the variations are noticed. This is explained by the fact that the thermometer can only indicate the temperature of one of the agencies which go to produce the actual baking heat of the bread. That agency is the oven atmosphere. When bread is being baked, the sources from which the heat is derived are the oven bottom, the pipes at the oven crown, and the materials of the oven. The thermometer by which we register the temperature variations is not in contact with any of these, but is near enough to the top pipes to register the amount, or rather the degree of radiant heat they give out, which degree is about the same as that of the oven atmosphere near the exposed bulb of the thermometer. The degree of heat as registered by the thermometer, therefore, always bears a direct relation to the heat of the pipes, but it does not bear the same relation to the heat of the material of the oven. At the beginning of the day's baking the heat of the oven material above the pipes is about the same as the heat of the pipes, and when the latter cool a little on the oven being filled with bread, they are likely to receive some heat by radiation from the oven materials, which assists in the baking. But as the day's work proceeds the oven material, on account of steadily paying back heat to the pipes to assist in the baking process, becomes considerably cooler than at the beginning of the day's work. In such circumstances, if with a good fire the pipes are highly heated, this excess will readily show on the

thermometer, but the baking efficiency may not be quite as great as when the thermometer showed the same temperature earlier in the day, owing to the absence of augmenting or compensating heat from the oven materials.

Another peculiarity noticeable in thermometric readings of the heat of an oven is that while the temperature may appear to decrease very suddenly when a batch is newly set, or when the oven atmosphere is filled with steam for glazing purposes, yet it appears to increase several degrees when the batch is drawn or if the steam is allowed to escape. These decreases and increases are rather due to local effects on the thermometer bulb than to real variations in the baking temperature of the oven. The baking temperature is likely always to be considerably less than the thermometer indicates when the oven is empty, and more than the thermometer indicates when the oven is full. One other point about thermometers in ovens may be mentioned here with regard to the great variations amongst them as to their effective baking heat. Thus, the proper heat as indicated by the thermometer for baking a batch of bread may be as high as 600° F., while another oven of a different type may seem only to need 400° or 420° F. to produce as good a result. This difference may be in some part due to difference in the construction of the oven—the number of pipes used, their nearness to the goods baking, and the nature of the oven materials—but it is frequently also due to the position in which the thermometer is fixed with regard to the heating tubes. The oven that seems to heat up quickest is not necessarily the best baker, indeed is not likely to be the best baker, for the conditions that favour very quick heating in this type of oven are also those that favour very quick cooling. Thus an oven with say fifty pipes spread over the width of the oven would be easier to heat than one containing a hundred pipes in the same space, but the latter would keep its heat at least twice as well, and would therefore be the much more effective baker. Again, tubes that contain say one 1 pt. of water can be heated to any given degree more quickly than tubes containing 2 pt. of water, although the latter should have twice the baking capacity. A little difference in the quantity of water in the tubes may not seem of very much importance to the baker, yet very little difference in the individual pipes makes a substantial difference in the aggregate. An oven with say seventy-two tubes, containing 1 pt. of water each, would have 9 gal. of water in which to store the heat obtained from the fuel, but if those tubes had each say 1½ pt., the heat storage would then be the equivalent of 13½ gal. of water, and the total *quantity* of heat at any given temperature in this water is half as much again as in the smaller quantity. This shows how important to the baker is the amount of water in the tubes, and it may be mentioned that oven tubes are not all alike in this respect.

Baking Heat.

As already explained the method of heating steam-pipe ovens is by a coke furnace, in which the ends of the tubes are exposed to a varying extent according to their relative position towards the fire. In the Per-

kins steam oven, of the original type (fig. 208), the bottom row of pipes constitutes the furnace bars, and as these only get that fraction of the furnace heat which descends, the extent of pipe exposed is much greater than if the pipes were above the fire wholly. The furnace in this type extends the full width of the oven. This necessitates two or three furnace doors. The pipes are quite straight, and the fire and the products of combustion come into direct contact with them; these pipes are heated partly by the hot gases, and partly and most effectively by radiant heat. To ensure perfectly equal temperatures in all the pipes, theory requires that the fire ought to be spread quite evenly, and theoretical considerations would also seem to indicate that, if the fire is not quite even, but larger and hotter in some parts than in

Method of Heating Steam-pipe Ovens.

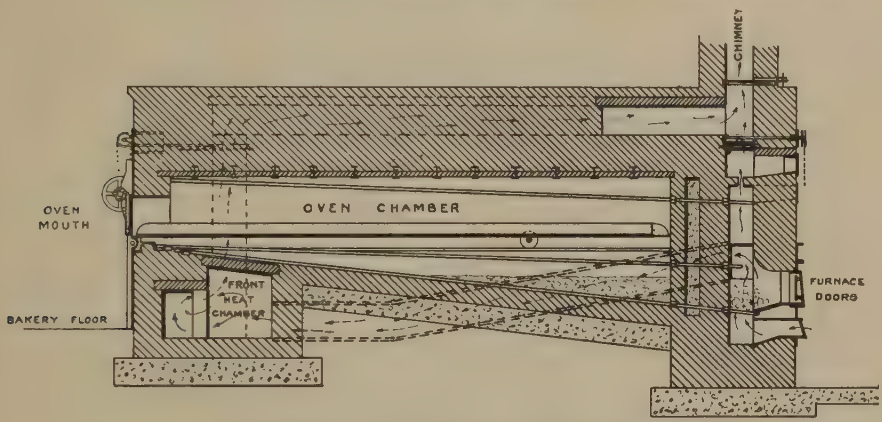


Fig. 209.—Section of Steam-pipe Drawplate Oven

others, the pipes in those localities would get intensely hot and be in danger of bursting. In practice there is little or no difficulty experienced in this matter. So far as can be indicated in the baking properties of the oven, the temperature seems equalized, and although the bursting of a tube from overheating is not unknown, yet in this particular oven such a fault is very rare, and is now more infrequent than some years ago when the manufacture and sealing of steam pipes were not so well understood. Yet there is some difficulty in keeping a long shallow fire of equal brightness for its whole width. To meet this trouble, the builders of this oven are now building a much smaller furnace with only one door. The fire is on furnace bars and the steam tubes are all placed above the fire, so that only a very short piece of each tube is exposed to the heat. To get the ends of all the tubes into this small space, they are of varying length, to allow them to be bent in such a way that they still form straight lines of heat under the sole and along the crown of the oven. In the Perkins type of oven, the bottom was until quite recently made wholly of iron plates, but a new preparation that gives all the effect of tiles without the seams has been in use in these ovens, and can be fitted to any ovens of the older type.

It is curious that drawplate ovens are now usually associated in the baker's mind with steam-pipe ovens, yet the drawplate principle is applied successfully to ovens of the hot-air type. The original drawplate, or at least the one with which the trade first became familiar in this country, was called the "Wieghorst", and was not a steam-pipe oven. In any case nearly all oven-builders who supply steam-pipe ovens are prepared to supply them of either peel or drawplate class, and in one or two decks, as required. When this type was first introduced, there was considerable trouble with the movable parts, especially in the case of imitators of the original builders. Small trolleys and rollers of various types were tried to make the plates easy-running, often with dire results to the poor baker and his batches. The difficulties are now quite overcome, and one hardly ever hears of any difficulty being experienced with the plates. It was for many a day protested that these drawplates, while suitable enough for baking the English sort of crusty loaves, were quite unsuitable for either the Irish or Scotch batched bread, but this prejudice has been completely broken down by experience, and now drawplates are in use in nearly all large factories. Improvements in details of the working parts of drawplate ovens are being gradually effected, but fundamental changes from original plans are more difficult. Thus in some types the trolley carrying the plate, or at least the end of the runners, is quite detached from these until the plate is being actually pulled out; but on the principle that in a bakery it is best to have every kind of mechanical appliance as simple as possible, it is perhaps better, at any rate the writer prefers, to have the wheels carrying the front frame of the oven as a part of that frame. An arrangement tried a few years ago was to make the oven bottom in laths carried on chains. This bottom was not pulled out in drawplate fashion, but by a mechanical arrangement the loaves placed on the laths at the oven front were carried into the oven chamber until the whole batch was set. When baked they were of course returned to the oven front in rows in the same manner. The object of this arrangement was to supply all the advantages of a drawplate oven for bakeries where the space was not sufficient to allow a long plate to be pulled out in the ordinary way. The plan did not seem to answer all the expectations of the patentees; it is now, however, successfully adapted to travelling ovens. But it is still a great difficulty in very small bakeries to install drawplate ovens, advantageous as these might otherwise be, on account of want of space, and to meet this difficulty the latest expedient of one of the leading firms of oven-builders is to use what is aptly called a split drawplate (fig. 210). The carriage of the split drawplate is pulled out into the bakehouse in the ordinary way but only half the distance. By an ingenious hand-wheel arrangement the front half of the plate is lowered enough to allow the back half to be pulled over it and loaded first; then the front half is raised and loaded. By this expedient only half the length of the plate is out at once, and very little room is needed in front of the oven, while some saving is also effected in the conservation of heat

Drawplate Ovens.

The Split Drawplate.

which follows from the plate in two sections being only half as long out of the oven for filling as the full-length plate must be, although the whole time occupied in this operation is not even in the latter case very great. The writer has had no personal experience of the "split plate", but is credibly informed that it is giving satisfaction.

Use of Producer Gas.

The use of what is called "producer gas" for heating steam-pipe ovens has now reached a comparative degree of perfection in some cases only; in others there is trouble with both the "producer" plant in which the gas is made and with its application to the ovens. Experience seems to show that it is better adapted for biscuit ovens than for those with steam pipes. The description of the method

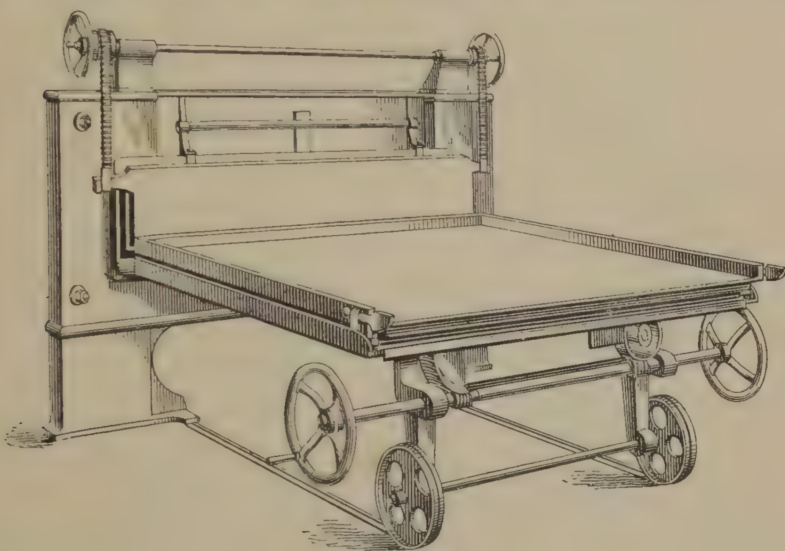


Fig. 210.—"Split" Drawplate Oven

of preparing the gas properly belongs to the chapter on fuel, and here it is sufficient to say that after it is made it takes the place of the ordinary coke fire in the furnace, but is burned in a special burner, which burns the gas mixed with air under the ends of the tubes, the air used for the purpose being previously heated by being allowed to pass through pipes placed in the flues for the purpose. Given an efficient producer that works without much attention, the economy and regularity of this kind of fuel can be easily surmised. It is under perfect control by taps like any other gas supply, and can be turned low or high as required, or turned out altogether. The pipes can be heated quickly, as compared with the time taken by an ordinary coke fire, and the heat can be distributed with uniformity. It may be pointed out, however, that the method of heating with gas is exclusively by convection—the flame may be in direct contact with the ends of the pipes, or the hot products of combustion passing over the pipes heat them. In this case there is practically little radiant heat effectively

used on the pipes, as the flame of burning carbonic oxide (CO), although itself very hot, has little radiant energy. Heating ovens by producer gas would not be economical if a plant and the burning apparatus had to be fitted up for only one oven, but for four or more large ovens the saving is considerable. It is highly probable that developments in oven-heating will be in the direction of the adaptation of producer gas for that purpose, and there seems to be no good reason why comparatively small plants for its erection should not be devised. Oil is the rival of gas.

The steam ovens hitherto noticed have been those with straight tubes, or with tubes bent so that their ends may all be clustered in one small furnace, but there is now on the market another form of steam-pipe oven called

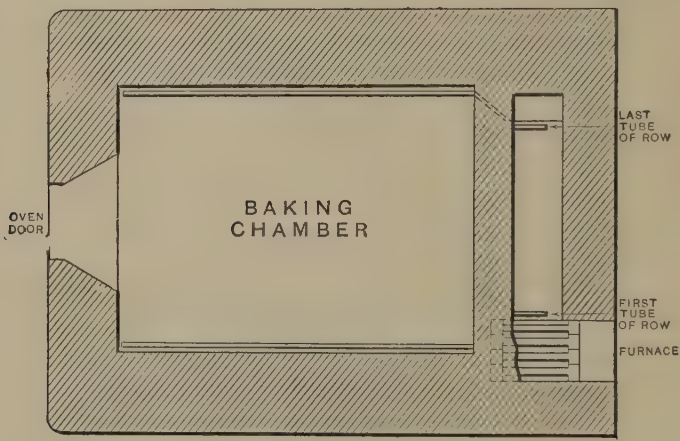


Fig. 211.—Hawkins' Patent Regulated Steam-pipe Oven: Plan

the "loop tube". In this particular oven the pipes are bent on themselves, so as to give practically double tubes at the front of the oven, so that the double heat supplied from these may compensate for the cooling effects due to the door. Ovens fitted in this way are well spoken of as being efficient bakers, the main advantages claimed for them being that they bake the bread uniformly to the front of the oven, and that the fuel required is not greater than in the ordinary steam oven.

Loop-tube Ovens.

There are many modifications of steam-pipe ovens now built so little different in principle from the original Perkins as not to require notice here, except that, as in all other kinds of manufactures, competition has induced some builders to economize in the wrong direction to enable them to produce cheaply—by using pipes of inferior quality, or by considerably reducing the number in the oven.

Inferior Steam-pipe Ovens.

One firm of oven-builders erect their ovens on a principle quite distinct from those already mentioned. The particular oven referred to is the Hawkins patent. In this oven the ends of the tubes are not in contact

with the flame, nor in the furnace at all. The furnace is comparatively small, with ordinary firebars. The heating tubes have their ends projecting into long shallow flues, through which the products of combustion must pass to get to the chimney. On the principle that the nearer the source of heat the shorter need be the length of tube exposed, these tubes project into the flues already mentioned in gradually increasing length the farther they are from the furnace. A reference to the plan of this oven (fig. 211), in which the first and last tubes in the bottom flue are shown, and to fig. 212, illustrates this point, and the claim of the oven-builder is that the varying lengths of pipe are so nicely adjusted that those farthest from the furnace are at exactly the same temperature, and are subject to the same internal pressure, as those near the furnace with

The Hawkins Oven.

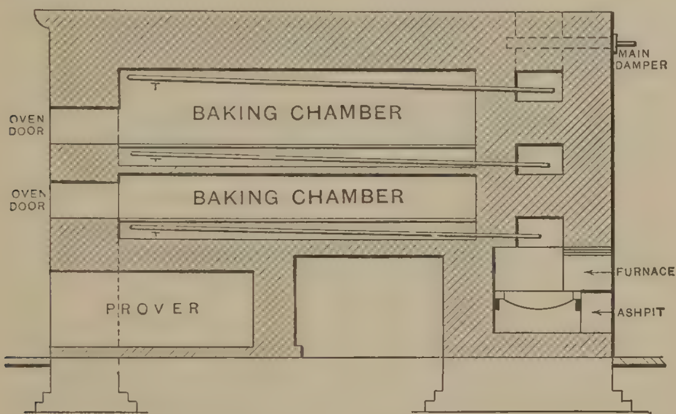


Fig. 212.—Hawkins' Patent Regulated Steam-pipe Oven: Section

a shorter length exposed, and on that account that there is no danger of tubes bursting. The method of heating here adopted is that of convection only. No radiant heat from the furnace can affect the pipes, and as the hot gases from the fire have to do all the heating, it is necessary that these hot gases should pass over the pipes as slowly as possible consistent with obtaining a good enough draught to burn the fuel properly, so that the pipes will absorb the heat. The fire is essentially a slow-combustion one. The patentee of this oven claims that it is extremely economical of fuel, and that two, three, or four ovens can be heated from one furnace, and all as nearly as possible alike, and that by an arrangement of dampers (fig. 213) the heat can be directed to either oven at will, or to the bottom or top of the oven as desired.

To this oven a special attachment is now adapted for the use of crude oil as fuel in place of coke. The appliances consist of a special burner which "atomizes" the oil, that is, blows it out in an extremely divided spray mixed with air, at a pressure about 1½ atmospheres. The power to supply the air pressure may be taken from the ordinary shaft used for the bakery machinery. As in most bakeries however, the use of power is

intermittent, the better plan is to provide a small half-horse power electric motor for the supply of pressure to the burner, or several burners, alone. As shown in the illustration (fig. 213 *a*), the oil burner is fixed in a position external to the oven furnace; its nozzle, in fact, is placed close to a hole, about 1½ inches in diameter, which has been drilled in the ordinary furnace door. Not only is the ordinary door as used for coke retained in this system, but the furnace itself is unaltered, except that special fire bricks are used at those parts at which there is the impact of the intensely hot oil flame. The ordinary furnace bars are not changed, except that pieces of broken bricks are placed on them on which may drip and be consumed any drops of oil when the burner is being lit, for there is no dripping after the flame appears. The furnace can always be reconverted for coke in a few minutes. The flame is injected into the furnace and

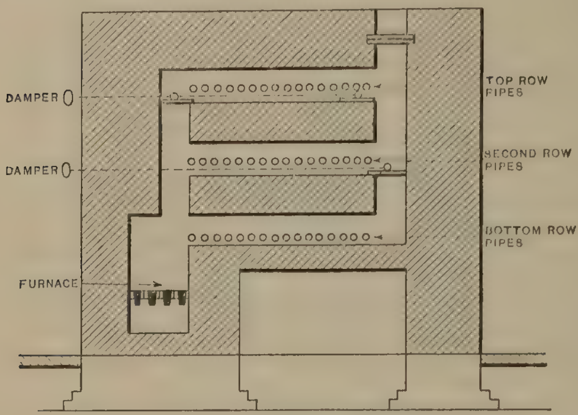


Fig. 213.—Hawkins' Patent Regulated Steam-pipe Oven: Sectional Elevation across Back

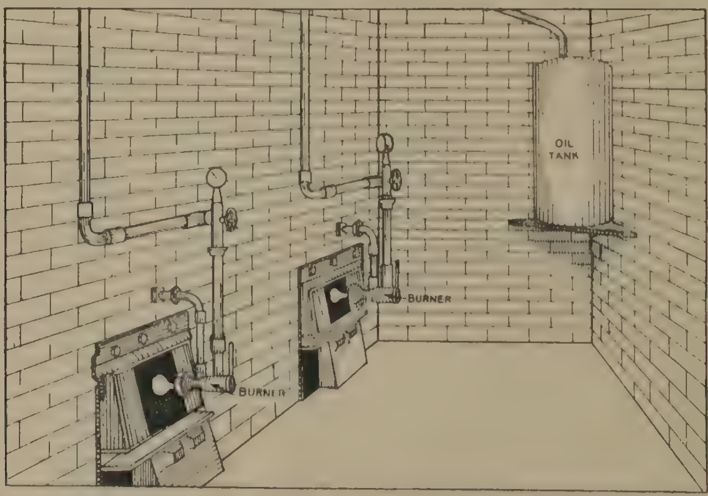


Fig. 213*a*.—Stokehold of Ovens, showing method of heating with crude oil

spreads out fan-shape; the material of the interior soon reaches incandescence. The products of the oil combustion at an intense heat then pass through the flue channels, and by convection raise the temperature of the tubes to the height desired. The oil flame does not in any case touch the ends of

the tubes, so there is no danger of their bursting. It is claimed that the temperature of a full-size drawplate oven can be raised 200° F. in one hour. The oil flame can be reduced to any desired extent as soon as the baking temperature is reached, and is kept at what may be called a heat maintenance level as long as work is being done, that is, as long as goods are being baked. The crude oil used is a by-product from the purifying of petrol, &c. It is extremely cheap, and does not burn except in the form of spray mixed intimately with air. In bulk, therefore, it is non-explosive. It appears that the system is not yet applicable to steam-

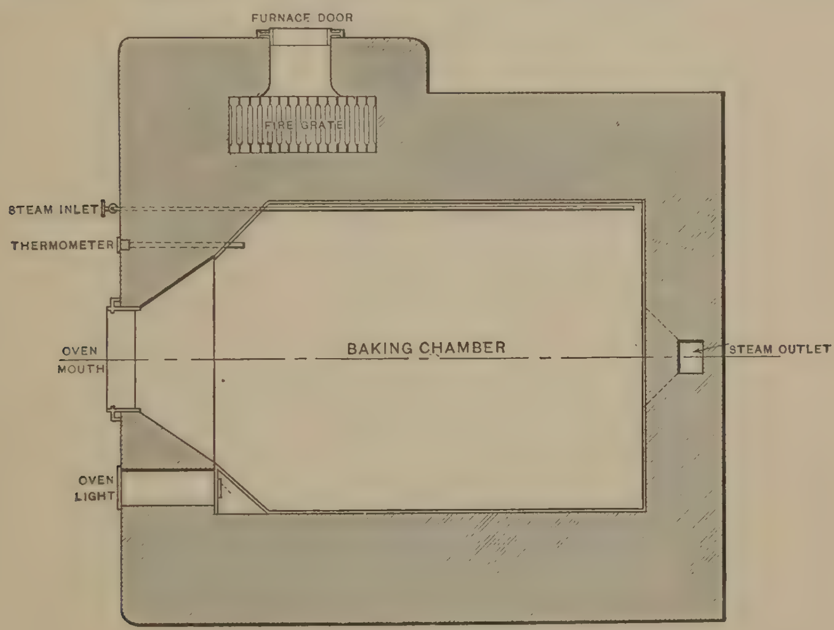


Fig. 214.—"Viennara" Patent Steam-pipe Oven: Sectional Plan

pipe ovens in which the flame comes into contact with the ends of the tubes, but these can be adapted to the system on which it is available. The cost of fuel, as compared with coke or gas, is very much reduced. The first ovens in which crude oil has been used on a commercial scale were those of Mr. Luce, of Wolverhampton.

"Viennara" Steam-pipe Oven.

Allusion has already been made to Vienna ovens of the hot-air type, but the steam-tube system is quite as well if not better adapted for ovens with sloping bottoms, and the accessories necessary for baking bread in an atmosphere of naked steam. Figs. 214–6 show an oven of this class with the registered name of "Viennara". The plan shows the position of the furnace at the side of the oven, and the position of the pipe for the inlet of naked steam to effect the glaze on the bread. The longitudinal section shows the position of the steam outlet flue at the top of the oven, so that the steam may be removed from the

oven atmosphere, and the baking of the bread finished in a quite dry heat (see Vol. I, p. 203). The front elevation shows the sliding door and the handle for control of steam damper, &c. This type of oven is now be-

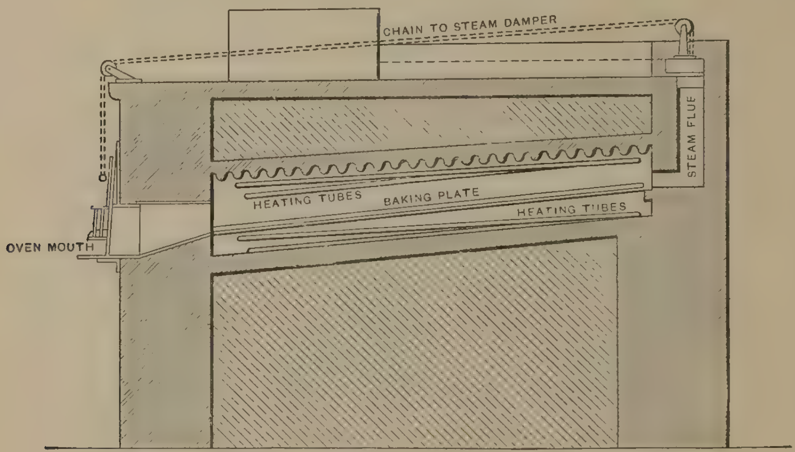


Fig. 215.—"Viennara" Patent Steam-pipe Oven: Longitudinal Section

coming much used here for Vienna-bread baking, and an oven of exactly similar construction is rapidly taking the place of the oldfashioned sort in Vienna, Berlin, and Continental capitals generally. The writer has

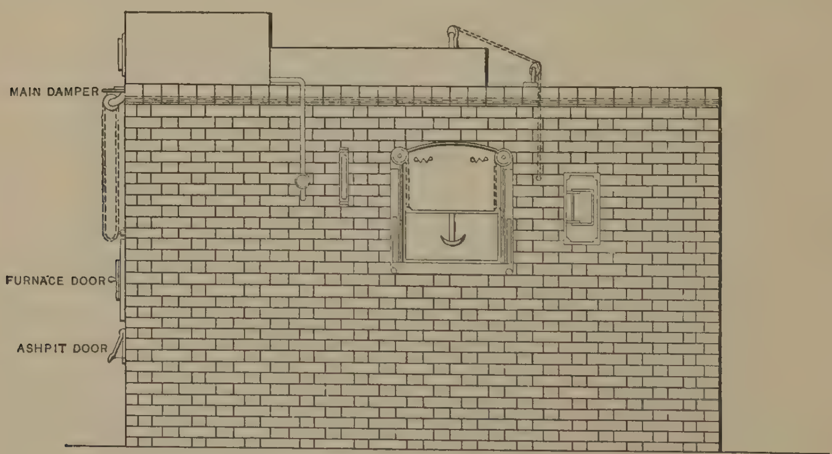


Fig. 216.—"Viennara" Patent Steam-pipe Oven: Front Elevation

been assured by those working with this oven regularly that it is very efficient.

A concluding general remark about steam ovens is that the essential things are the quality of the pipes, the maximum quantity of water in them, and the sufficiency of the number in the oven. The oven walls

should be substantially built, although not necessarily thick, and the part above the pipes should be well insulated with a good thickness of material, as it is important that the oven structure should to some extent act as a heat reservoir. The writer favours a small furnace, with the end of the pipes massed into small space, rather than the long furnace that needs careful spreading of the fuel to obtain uniform heating, for the smaller furnace seems in his experience to be more economical, because easier to control, and there is much less danger of losing the heat actually generated. He also favours furnace bars with all the pipes above the fire rather than that the pipes themselves should be the bars. These, however, are only opinions, but based on experience with various types of steam ovens.

Essential Points in Steam-pipe Ovens.

CHAPTER II

FUELS: THEIR COMPOSITION AND HEATING VALUES

Anything that burns will heat an oven, yet some care is needed in selecting fuel, and the cheapest is not always the most economical. Burning is a chemical process subject to the same laws as other chemical combinations. The carbon and the hydrogen of the fuel, whatever it may be, unite chemically with the oxygen of the air, and so produce greater or less heat. These two substances, carbon and hydrogen, are practically the only sources of heat in fuel, yet it must not be understood that they are always burned as pure substances. They are both present in organic materials, to which class fuels belong, as compounds, and the nature of these compounds determines the amount of heat they will give out when burned. Thus, if hydrogen is already combined with oxygen, it will be in the form of water, and from that portion of hydrogen no heat whatever will be obtained; but as much heat is required to convert the water into steam, the presence of any considerable quantity in the fuel will seriously reduce the total heat obtained from it. Again, if the carbon is combined in the fuel with the complete quantity of oxygen that satisfies it, it is already in the form of carbon dioxide (CO_2), which is the ultimate product of the burning of carbon in oxygen, and therefore cannot be further burned so as to produce more heat. But if one part of carbon has formed a compound within the fuel with one part of oxygen only (CO), that compound is combustible and will burn to CO_2, producing a great deal of heat while the change is being effected. It will thus be seen that the actual composition of a fuel is not a quite safe index of its heating power. There are other substances in fuel also that are themselves quite useless as heat-producers, but hinder in a mechanical way the burning of the combustible

Chemical Combination and Heat Production.

parts by imprisoning these to some extent, or by forming clinker on the furnace bars and considerably reducing the draught through the fire. Yet given the composition of a fuel, the theoretical heat production can be roughly ascertained, and after making allowances the heating values of different sorts of fuel can be compared. It is not necessary in a work like this to describe analytical methods of ascertaining the composition, but it will be sufficient to give the proximate analyses of fuels that are used in bakers' ovens or in stoves, with the ascertained calorific values The tabulated figures here given may vary somewhat from figures obtained from other sources, which differences may readily be explained by real variations in the composition of various samples of the same kinds of fuel. The table, however, has been compiled from the best available sources, and the relative figures may be accepted as correct. One pound of fuel is the quantity to which the number of heat units given refers. The constituents in the composition are given in percentages.

Composition of Fuels.

Fuel.	Heat Produced in Heat Units. B.T.U.	Composition.					
		Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Sulphur.	Ash.
Charcoal ...	8,000	100·0	—	—	—	—	—
Coke	7,400	98·4	—	—	—	1·22	5·34
Newcastle coal	8,200	82·12	5·30	5·7	1·3	1·24	3·77
Peat (dried) ...	4,700	59·0	6·0	30·0	1·2	—	4·0
Wood (dried) ...	3,547	50·0	6·0	41·0	1·0	—	2·0
Carbonic oxide	2,415	42·86	—	57·14	—	—	—
Hydrogen ...	33,800	—	100·0	—	—	—	—
Alcohol ...	8,000	52·17	13·04	34·79	—	—	—
Petroleum ...	10,700	85·0	13·0	2·0	—	—	—
Welsh coal ...	8,240	83·78	4·79	4·15	·98	1·43	4·91
Scotch coal ...	6,280	78·53	5·61	9·69	1·0	1·11	4·03
Marsh gas ...	13,100	75·0	25·0	—	—	—	—

As the free hydrogen in those fuels combines with the oxygen of the air to form water, and the carbon with the oxygen of the air to produce either carbonic oxide (CO) or carbon dioxide (CO_2), it is easy to see that these fuels will require different proportions of air to effect their complete combustion. Thus 1 lb. of pure hydrogen burning in air would need 35 lb. of air; 1 lb. of pure carbon if burned to carbonic oxide needs 5½ lb. of air, but if burned to carbon dioxide it requires 11 lb. of air; 1 lb. of dried coal needs about 4 lb. of air, and 1 lb. of dried wood only 2½ lb., while 1 lb. of peat (dried) requires 3¼ lb. of air for its complete combustion. A pound of coke needs 10 lb. of air to burn it thoroughly. These are, of course, theoretical figures; but they show how it is that some kinds of fuel take longer to burn than others, and they also indicate how a much stronger draught is needed to burn, say, 10 lb. of coal in a given time than to burn the same weight of wood. In the case of coke the

Air Supply for Combustion.

draught needed is not so great as in the case of coal, not because coke does not require so much air, for it needs more, but because the burning process is spread over a longer period. For the following descriptions of the various sorts of coal the writer is indebted principally to the large work on *Chemistry* by Roscoe and Schorlemmer.

Anthracite Coal.

Anthracite coal contains a larger proportion of carbon than other coal. Its condition and peculiarities are due to its having undergone the most complete change from woody fibre. This coal has a bright lustre, an iron-black colour, and is frequently iridescent. Anthracite gradually passes into bituminous coal, becoming less hard, and containing more volatile matter. As it burns practically without smoke when the draught is sufficient, it is largely used in all circumstances where intense heat and freedom from smoke are considerations. Under the name of "blind coal" it was, and probably is, used in Scotland for oven-heating purposes. The absence of volatile gases in anthracite enables it to be burned in almost the same manner as coke—without flame—yet in an oven in which this coal is used there is, especially on a fresh fire, frequently a long pale-blue flame. This is produced by the carbon of the coal being formed first into carbonic oxide, which is an inflammable gas; the flame is caused by this gas burning. Anthracite can also be used in place of gas coke in all types of ovens and furnaces for which the latter is suitable; but, except in favoured localities in the neighbourhood of anthracite pits, its price is so much greater than gas coke that the latter is most favoured.

Bituminous Coal.

What is called bituminous coal consists of a number of varieties with different chemical composition and yielding different products when burned. They have the common property of burning with a smoky flame, and yield on distillation volatile hydrocarbons and tar or bitumen, whence their name is derived. The most important kinds of bituminous coal are: (1) *coking coal*, which softens and becomes pasty or semi-solid in the fire, and yields, when completely decomposed, a greyish-black cellular mass of coke; (2) *non-coking coal*, which is much like the other in its chemical composition and in all its internal characters, but burns freely without softening and without any appearance of fusion: the residue it yields is not a proper coke, but is either in powder or in the form of the original coal. This is the common coal of commerce.

Cannel Coal.

Cannel coal, sometimes called parrot coal, is a variety differing from bituminous in texture and containing usually more volatile matters, and on that account it is specially employed for gas-making. Cannel coal is more compact than bituminous, has little or no lustre, does not show any banded structure, and has a dull black or greyish colour. Small fragments, when lighted, will burn with flame; hence the term candle or cannel coal. Although this coal is used mostly for gas manufacture, it can be used with advantage in ovens of the side-flue type, or others in which a long flame is desirable.

Brown coal or lignite is not common in Britain. It consists of the remains of trees or shrubs which have been comparatively recently submerged and pressed into a form of coal. It is brown in colour, and has sometimes a characteristic woody structure. The substance called jet is really a black variety of this brown coal. Brown coal is only a little higher in the scale as a heating agent than peat. There is an earthy brown coal which is very friable, and is sometimes found in layers between the beds of lignite or true brown coal; but this substance differs from a true coal inasmuch as a considerable portion of it is soluble in ether and benzine, and even in alcohol, while a true coal is nearly if not quite insoluble in these substances.

Brown Coal or Lignite.

Peat, or, as it is sometimes called, "turf", is a material which is being constantly formed by the decomposition of marsh plants, chiefly mosses, &c. It also contains nitrogenous compounds, which are the cause of the peculiar smell which it gives off on heating, and it is very rich in ash. The manner in which peat is used for heating ovens has been already described. Except in country villages near peat moors it is not now much used for this purpose.

Peat.

Coke, as used by bakers, is the residue left after all the volatile products have been driven out of it by heat in the retorts in which it is made. It consists essentially of a mass of carbon mixed, of course, with the mineral matter that was in the coal. The quality of the coke depends very much on the amount of mineral matter it contains. It is this mineral matter from which clinker is produced, and the tendency to form clinker and its amount are greater the higher the ratio of ash to carbon in the coke. When coke is quite fresh its heating power is greater than after it has been stored some time. This is due to the fact that a sort of slow combustion is going on all the time—part of the carbon of the coke is combined chemically with the oxygen of the air and carbon dioxide is produced, and this carbon has no further heating effect. The gradual oxidation here referred to is, however, so slow that no perceptible heat is produced while it is going on, yet it reduces the heating powers of the coke considerably after a long period.

Coke.

It is a common expedient with ovensmen using coke to wet it well before charging the furnace with it, the object being to make it burn better and brighter. This effect of water is really of a mechanical kind. When there is a good deal absorbed in the coke this very quickly generates steam when the coke is thrown into the furnace, and the solid coke is partly broken down by the effort of the steam to escape, and the coke therefore exposes a much larger surface to the air passing through the fire while it is burning, and so better combination takes place and the coke burns brightly. But this effect is not produced without some loss of heat, for the water requires a good deal of heat to change it into steam. It will be noted, therefore, that wet coke has not really more heating power than dry coke, but when it starts to burn it burns quicker for the reason stated.

Wet Coke.

It is a mistake to throw coke on a fire in very large pieces, as some men do. The fire has then to do the purely mechanical work of breaking up coke, and some of the heat is used up in that process, and is therefore not available for its own proper work of heating the oven. In addition, large pieces of coke do not give nearly so much heat as small pieces. If quite dry they do not break down readily, and when they burn as large pieces it is only the outside surface that burns, and this is a comparatively small surface in relation to the total bulk of the solid matter. The most efficient coke fire is made by using the coke in small pieces of uniform size.

Small Pieces of Coke Best.

Reference has already been made to the method of burning coke in Scotch and in certain types of externally-heated ovens in which economy is secured by effecting combustion at two stages, instead of completing it in the furnace proper. In this method the air supply is insufficient under the fire, but is augmented by a supply over it, so that the first stage consists in some part of converting the coke into carbon monoxide, and this substance burns with a long pale-blue flame above the fire, thus projecting the point of maximum heat a considerable distance from the furnace proper. This system is not suitable, however, for ovens of the steam-pipe class if the ends of the pipes are actually in the furnace, as there the maximum heat is more effective if in the furnace proper. But whatever kind of oven is being heated there is an economical and a wasteful method of using the fuel. Thus it is wasteful if the quantity of fuel is greater than the air space between the bars will supply draught for—that is, if the fire is too large—unless there is an air supply above the fire to burn the inflammable gas produced. It is wasteful in the case of steam-pipe ovens when you have too quick a draught; when there is a small fire and too much draught; when the fire is allowed to burn low and then a large charge of fresh fuel is piled on; and when the coke is used in large lumps. On the other hand, economy is obtained when the draught is nicely regulated to the size and condition of the fire; when the fire is kept very bright; when it is not allowed to burn into holes or to burn too low before fresh charges of coke are added. If a record is carefully kept of the amount of coke used per day on an oven before any goods are baked in it, this matter of the economical use of the fuel will be easily demonstrated. It is quite a common occurrence in the bakery for a much larger quantity of fuel to be used than is necessary and larger than the equivalent heat obtained. The table on p. 44, taken from a published lecture of the writer, illustrates this point.

Economical Use of Coke.

The heat ratio to fuel for this same oven on other occasions has been as high as 4° F. per lb. of coke used, but the tabulated figures here given show how variable the results may be. How variable they are in everyday bakehouse practice is not generally known, as detailed records of firing are seldom kept so accurately as they should be. It is not enough that the cost of fuel week by week and month by month be ascertained, but the quantity used each day, with the increase of heat obtained

Firing Records.

HEATING TESTS ON STEAM-PIPE OVEN

	Oven Heated from Temperature.	To Temperature.	In Hours.	∴ Through Temperature.	Quantity of Coke Used.	Ratio of Rise in Temperature per lb. of Coke.
	Fahr.	Fahr.		Fahr.	Lb.	Fahr. deg. per lb.
1	375°	465°	5	90°	55	1·63°
2	375°	480°	6	105°	42½	2·5°
3	350°	435°	4	85°	64	1·32°
4	305°	420°	4	115°	47	2·5°
5	370°	435°	4	65°	75	·87°
6	390°	440°	5	50°	42	1·2°

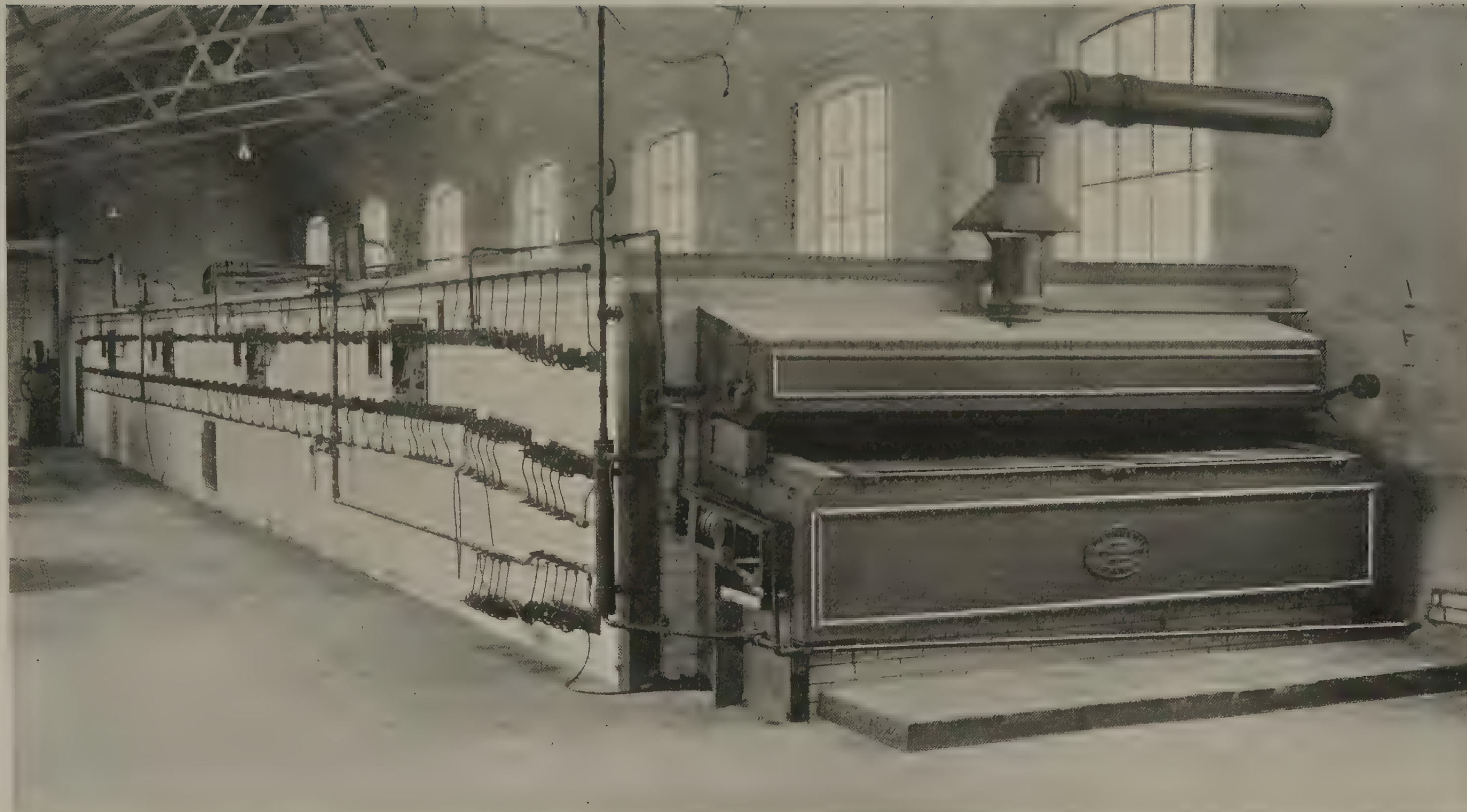
from its burning. On the weekly or monthly record several days of economical firing within the period may be sufficient to compensate for other days of wasteful work, and so the average for the whole period may be quite good. But a daily account, which is not difficult to keep, shows the ovensman as well as the employer that the good firing may be as easily repeated as the bad, and in consequence greater care is likely to be exercised, to the advantage of everyone except the coke merchant.

Coke and coal being solid substances, the lumps variable in size, and the furnace and expedients for catching the heat being difficult to regulate, there have been many attempts made within the last few years to apply gaseous fuel for oven-heating purposes. Ordinary coal gas has long been in use in small ovens, the gas being burned practically in the oven chamber in the ordinary atmospheric burners, which consist essentially of perforated pipes open at one end for the admission of air, which mixes with the gas before it ignites and ensures its complete combustion. This is, of course, the most economical method of burning gas for heating purposes, and but for cost there is no reason why ordinary gas could not be used to heat large ovens, even those of the steam-pipe sort. By using a special series of gas burners in a Scottish type, Mr. Crosby, of Newcastle, effectively and economically bakes a large quantity of small goods, but the oven is not so suitable for bread baking.

Heating of Ovens by Gas.

Several systems of gas-manufacturing plants have been designed and applied to the heating of steam-pipe ovens, but they have not all been successful. The special apparatus for gas production is called a "producer plant", and the gas manufactured "producer gas". These plants have long been in use for power purposes, but for oven-heating they are comparatively new. The apparatus consists of a cylindrical receptacle with thick insulated walls, but closed at the top except for gas outlets, and only partly open at the bottom, or only having pipes to provide a limited air supply. When the apparatus is to be used, a fire is lit at the bottom, generally with coal, and then the cylinder is filled up to a depth of 2 or 3 ft. with coke similar to that in ordinary use by the baker. The whole mass of fuel becomes highly heated, but the

Producer Gas.



GAS-FIRED TRAVELLING OVEN

air supply from the bottom is kept purposely deficient; the result is that the carbon of the coke burns in a supply only sufficient to form carbon monoxide, and as there is no air at the top of the fire to allow this gas to burn it is collected as a gas in a receiver, and from there conveyed by pipes to special burners underneath the ends of the steam pipes in the oven furnace. The working of the producer plant is practically automatic, requiring no attention except to see that a sufficient supply of coke is maintained. There are no mechanical appliances connected with it. It needs to be charged with fuel only once in eight or nine hours, and then only needs to be observed from time to time to prevent the fire from burning into holes or from being choked with clinker. One successful oven plant of this kind known to the writer can be kept alight for days if not required, and the generation of gas can be stopped by simply cutting off the air supply. There is no storage tank or purifying apparatus attached beyond that in the producer itself: the gas is led straight into the oven in which it is to be burned.

Water-Gas Plant.

In the special producer referred to above, which is really a modified form of producer and water-gas plant, the air supply which keeps the fire going is heated before it enters the generator, and an automatic arrangement also supplies a small quantity of water vapour which passes through the fire along with the air and is broken up into its constituents, the resultant producer gas therefore containing a quantity of free hydrogen which has a very high heating power. The gas from the producer is conveyed by a pipe to the combustion chamber (oven furnace), where it issues in a thin film under the end of each steam pipe. At the same time it is mixed with air also in a thin film, but the latter is previously heated by passing through a pipe located in the oven flue. The air and gas impinging on each other are intimately mixed, and being lighted by an electric spark or otherwise the mixture burns with a pale-blue flame producing much heat. The special burner is so arranged that the flame nearly envelops the ends of the pipes, and passes along the row of pipes, parting with its heat on the passage before it finally reaches the flue. Each oven or each separate row of pipes can have a series of burners for itself. As gas and air are both gaseous they are easily mixed, and the combustion is more complete than is the case with solid fuel; then, as the area of the oven pipes is small they can be more effectively heated with gas than with the flame of undistributed gases from an ordinary fire.

Producer Gas and Water Gas Compared.

Producer gas proper consists essentially of carbon monoxide (CO), but all kinds of modifications have been made for the admixture of hydrogen from water vapour or steam, which mixture in its extreme quantities is the basis of what has been called "water gas". We shall try to explain the difference in the two kinds of gas. A water-gas plant, like the other described, consists of an iron cylinder jacketed and insulated. This is filled to a depth of 3 or 4 ft. with bituminous coal or with coke, which is lighted at the bottom as in a producer apparatus. There is no air supply to keep the fire burning, except through

a pipe connected with a pressure boiler. From this a mixture of steam and air is injected into the producer. In some types the steam and air are not injected together. The air is forced in first until the whole of the contained coke is raised to a white heat; the air supply is then shut off, and steam under pressure and in a finely divided state is injected through the mass of white-hot coke. In these circumstances the steam is dissociated into its elements oxygen and hydrogen, the oxygen of the water or steam forming carbon monoxide with the carbon of the coke, while the hydrogen of the steam remains a free gas. The water gas can then be collected as it comes from the producer, and consists of a mixture of carbon monoxide and hydrogen, which mixture has a very high calorific value. This cycle of air and steam blasts is continued at regular intervals. The difference between this system and the producer system first mentioned is in the nature of the gas mixture, and the necessity for some form of mechanical power in connection with the former to open and shut valves, and to supply the alternate blasts of air and steam. The high heating value of water gas would make it quite suitable for oven-heating, but the elaboration of plant necessary and the machinery parts add so much to the expense and the cost of attendance, that the automatic arrangement first described is likely always to find more favour in connection with bakers' ovens. A description of a liquid fuel—crude oil—is given on p. 37.

A type of oven called "Hotso" was projected some twelve years ago, to be heated with superheated steam. The steam was first generated in an ordinary boiler, then highly heated, by passing through a coil of very highly heated pipes, afterwards circulating round the oven. The plan was not a success.

Electric Heating.

It may be worth noting here that in connection with small experimental baking plants attached to some large flour mills, the heating power of the ovens is electricity. The baking chamber is surrounded with a coil of high resistance which can be heated to any temperature at once, and baking operations can be conducted at any time desired. The adaptability of the oven for immediate use at any time is compensation, in the circumstances of the miller's bakery, for the high initial and maintenance cost, but under present conditions these costs prohibit the use of such a system of heating in ordinary commercial bakeries.

Draught.

A chapter on fuels and oven-heating would hardly be complete without a few notes on draught, the conditions that hinder and those which favour it. There are certain points about draughts that nearly everyone knows, although not everyone knows their explanation. Thus it is well known that a close fire burns better and easier than an open one; that a fire burns better on a very cold day than on a warm close one; that the draught is poor when a fire is newly lit; that when there is a separate chimney to each fire, particularly to each oven fire, the draught is better than when many flues enter one chimney; that a high chimney, other things equal, gives a better draught than a low one. Before dealing with these specific points it may be as well to explain exactly what causes a draught at all. The draught in a chimney is the result of the hot air in

the column being much lighter, bulk for bulk, than a column of the same area and height of the cold air outside the chimney. To understand the principle of the matter, imagine the chimney to be one arm of a great U tube, the other arm being an imaginary stack of the same height as the chimney, but filled with air at the temperature of the atmosphere. The cold air balances or overbalances the hot air in the chimney, and pushes it upwards, because the whole weight of the latter is so much lighter than the whole weight of the former. Then as air or any gas becomes lighter the hotter it is, so the hotter the air in the chimney is the lighter it is compared with the outside air and the stronger push the latter exercises on it—in other words, the draught becomes stronger. This explains why the draught is so much better in connection with a close as compared with an open fire, because in the former the products of combustion are hot and pass up the chimney alone, while in the latter they are mixed with much cold air, and are therefore cooler. This also accounts for the better draught on a cold day than on a warm one, because on the former the outside air is colder, and therefore heavier than on the latter, and therefore its overbalancing effect is greater, that is, the draught is greater. The coldness and therefore heaviness of the air in the chimney when a fire is newly lit accounts for the poor draught at that stage. But it should be particularly noticed that it is not the absolute but the relative weight of the air column that is the essential in draught production. Thus a tall chimney gives a better draught than a low one, because the relative difference in weight between two tall columns of hot and cold air is much greater than the differences in weight between two short columns at the same temperatures. The bad effects following the impact of several flues into one chimney are due to the fact that a stream of hot air entering the chimney from the highest up flue has a certain "way" on it, and from its opening may flow across to the opposite wall of the chimney to that at which it enters before it takes a direction upwards, and to some extent may act as a damper to the currents from the other flues, particularly if the products of combustion from any of these are colder and heavier. The use of chimney pots on the top of chimneys as draught improvers is to prevent the undue expansion and cooling of the upward current of hot air; the narrowing of built chimneys is for the same purpose. Cowls and other expedients are to prevent down draughts of cold air, which have both a cooling and retarding influence on the upward currents. Yet it is obviously not good policy to allow the hot products from an oven furnace to enter the chimney very hot, as they are past their work of heating the oven then; hence the economy of slow-combustion furnaces and other expedients which do not require a quick draught as long as it is sufficient. It is better, therefore, in connection with oven-heating to adopt all contrivances that will conserve heat in the chimney, and all contrivances that will ensure complete combustion of fuel and its economical use, than to obtain draught by letting much of the heat pass up unused.

CHAPTER III

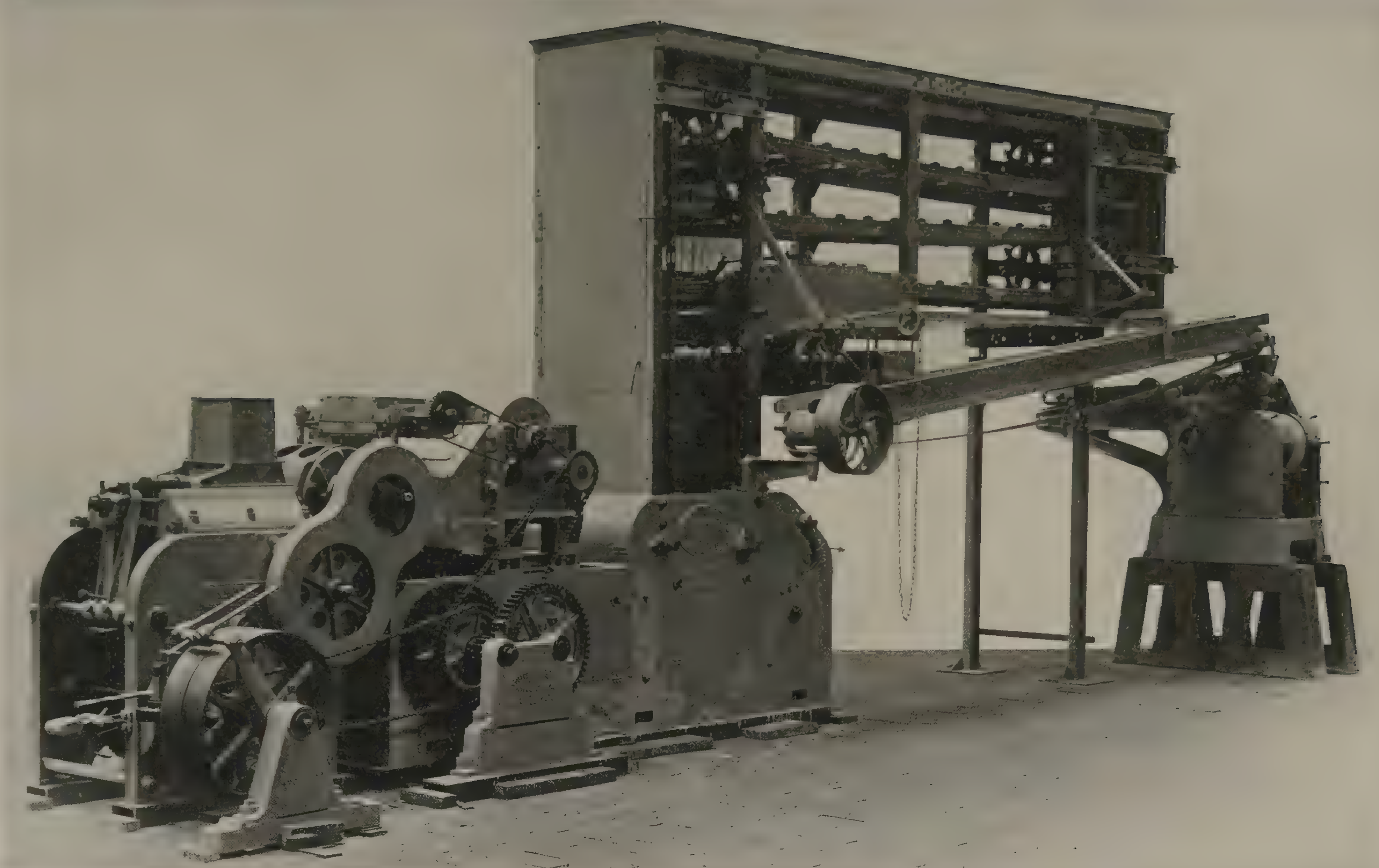
MACHINERY IN THE BAKERY

We are now so familiar with machinery of all kinds in the bakery that it is difficult to realize that in 1860 machinery for bread-making or confectionery was something of a marvel, whilst ten years earlier it was non-existent. This last statement may need qualifying in a certain sense, because there were many efforts made, as the patent records show, to apply mechanical agencies to mixing and kneading dough, but these were not adopted in a commercial way by the trade, probably because their effectiveness was not sufficiently demonstrated by their inventors; because the baking trade of that day was in the hands of small bakers for the most part; and because there were no small and cheap power agencies like gas or oil engines or electric motors, and if power was needed it had to be wind or water or steam, and either of these implied much initial expense and larger operations than the great majority of bakers could contemplate. It has been confidently asserted that the first dough-making machines for hand power originally were in use in Glasgow about 1850, but there are no very reliable data on this point. In 1853 a Mr. Deacon, of 11 Chester Street, Kennington Lane, London, was the only baker in that city then using a machine for dough-making. This was the invention of M. Rolland, a French baker, who was also the inventor of the original type of oven already mentioned as the Rotary. This machine also was hand-driven. It was undoubtedly in Glasgow that machinery was first used on a large scale, the type of machine being that in which the mixing parts are like the thick blades of knives working on a frame, and with sets passing each other in opposite directions.

Introduction of Machinery into the Bakery.

The growth of bread factories has been the immediate and inevitable result of the adoption of machinery in both bread and small goods departments, and bakers in a small way of business have been not unnaturally alarmed, and think that these factories are likely to destroy their trades entirely. This view is probably a wrong one, or at least may readily be made so if the small bakers will only exert themselves to follow the stricter economies and correct business methods of the factories, instead of continuing the loose and haphazard methods that too often prevail in the small bakery. It is the method of the large establishment rather than its machinery that gives it the advantage over the small bakery. The only part of the bread-making process in which machinery can effect any considerable saving in cost of labour is in connection with mixing and other processes in the manipulation of the loaves, but bread is one of those commodities in which the cost of labour of manufacture is relatively small in any case. Even in a comparatively small bakery it may not be more than 4*s.* 6*d.* per sack (280 lb.) of flour, while in

Growth of Large Factories.



"ROTADIBOX" PLANT: DIVIDER, SPINDLE HANDER-UP, PROVER, AND SPINDLE MOULDER

the largest factory, with almost automatic plant, it may be as much as 2*s.* 6*d.* per sack, and can in the present state of machinery development be hardly less than 2*s.* per sack. This lowest estimate gives the factory an apparent advantage of 6*d.* per sack, which may be augmented by the advantage a large firm has in buying flour, &c., in considerable quantities. But whether the large firm distributes wholesale or retail, the cost for distribution is always much higher than the proportionate costs in the smaller business. The latter distributes its bread, &c., in a narrow area surrounding the shop, and in cases uses up the residue labour from the bakery for the purpose, while a good deal of the trade may be actually done over the counter. On the other hand, the factory has to send its bread far from the establishment, and, even in the area served, the customers may be much scattered. These conditions all absorb energy and increase cost of distribution, and this increase over the costs of the small baker for the same department of the business may be considerably greater than the advantage gained by saving in the cost of manufacture. Now that dough-making machines can be obtained at a moderate price and motors may be hired, it is a very small bakery indeed that cannot profitably employ such a machine, and when dough-making is done the most exhausting part of the work is over. The question is very frequently asked whether a trade of fifteen sacks or so is sufficient to warrant the purchase of a dough-making machine. All experience teaches that it does; indeed, it is quite exceptional now to find a small bakery in which dough is hand made.

Cost of Labour per Sack of Flour.

The prejudice against machines for dough-making is now almost dead, but one still hears the assertion made that "machines kill the dough and never make it as good as that made by hand". This idea is based on the fact that hand-made dough does, unless very tight, give signs of fermenting quicker than machine-made dough. This is only because the latter is at first closer in texture and its gluten tougher than that of the former, and until a considerable quantity of gas is produced within the dough it does not so readily become soft and spongy as the other. But in spite of the absence of signs of working the yeast is probably fermenting as quickly in the one case as in the other, and the machine-made dough works quicker at the later stages than the hand-made, and certainly ferments more steadily. The fault ascribed to a machine of "felling" the dough is often an imaginary one because the dough happens to feel solid. There is not any danger of hurting the dough by pressure at the making stage be that ever so severe, while very thorough mixing helps to toughen the gluten and to enable it to become better hydrated (to absorb more water), and the quantity of dough is in consequence increased. One kind of fermentation-retarding effect the machine may have is in considerably reducing the temperature of the dough below the point at which the yeast works satisfactorily. In ordinary circumstances this cooling effect can be duly allowed for by keeping up the temperature of the water, but in very cold weather there is some difficulty about this. It is better, therefore, that the dough should be kept in the machine as short a time as possible

Machine-made Dough.

provided that it is thoroughly mixed, especially in cold weather. It is possible, when through any cause the dough is mixed for a long time, it may be cooled so much as to work very slowly and to be still unripe in the time that it is usually quite ready. This warning is not needless, although there are cases in which the dough may be actually left to ripen in the machine altogether, a method sometimes followed by those using a machine called the "Globe". This machine is a large hollow sphere suspended from the ceiling of the bakery, its internal mechanism consisting of large knives that revolve and cut through the dough while mixing it. The capacity of the sphere is considerable enough in some cases to allow five sacks to be mixed at once; therefore if only two sacks are made into dough, there is plenty of room within the machine to allow the dough to prove. As this machine is invariably fixed in the ceiling, the atmosphere surrounding it is warm and the machine itself is also warm. It seems evident that in a moderately warm bakery a machine has neither a "felling" nor a cooling effect on the dough. Were it otherwise the dough would be entirely destroyed in those machines that require to mix it for as long as twenty minutes, the machine working all the time at a high speed—in such a machine, for instance, as the Corby, so extensively used for pan bread in the United States and Canada.

The "Globe" Dough-making Machine.

An opinion prevalent amongst bakers and encouraged by engineers is that the virtue in a machine consists in the speed with which it can make dough: the machine that mixes in six minutes is supposed to be ever so much better than the one taking eight minutes. It is not in the saving of time only that the excellence lies, but it is assumed that the speedy mixer is also the light mixer, and the lightly mixed dough is supposed to be most like that made by hand. There is not much in this contention. Lightness of dough is not everything, and thorough mixing is important. Nor does the quick-mixing machine necessarily save the machineman's time, for if the whole operation is only to occupy four minutes, he is likely to stand at the machine waiting on it; but if the process occupies ten to fourteen minutes, then he may be getting on with some other work while the machine is in operation. As a time-saver only, a dough-making machine to a small baker is not so very important, but as an energy-saver it is. In a trade of from twelve to fifteen sacks, the whole operation of dough-making by hand occupies not more than from one and a half to two hours per day, or a weekly total of from nine to twelve hours. The use of a machine will not entirely remove this time charge. It will still be necessary to "pitch" the flour, measure water, ascertain temperature, weigh yeast, salt, &c., start the machine and attend to it, and attend to the dough when finished. After due allowances are made, the whole time saved is probably not more than five or six hours per week, and as this time is no appreciable proportion of a week's work for a man, it is quite evident that a dough-making machine in a small business of this sort will not allow of a reduction of the staff; all it will do is to relieve the men from the most exhausting part of the day's work, and in

Speed in Dough-making Machines.

consequence improve their capacity for doing the remainder of the work better, and for doing a little more each when occasion arises. This applies also to larger trades of twenty or forty sacks per week. If a trade which nominally requires five men, when hand work is the rule, is assisted by machinery, the staff may then be reduced by one man, so that four men with dough-making machinery only should be able to do as much work as five men without. But it seldom happens that the adoption of machinery entails a reduction of staff; it is usually rather followed by more business and a larger staff. The expense incurred seems to act as a spur to sharpen up the master baker to improve his methods in all directions, and in most cases increased business is the result. To the small master who is his own foreman a dough-making machine sometimes makes all the difference between success and failure. Many a thoroughly good baker has undone himself after starting in business by tying himself too closely to the bakehouse and using up all his energy there, leaving himself neither time nor energy to look after his books and the trading side of his business.

Dough-making Machinery and Labour-saving.

The following general remarks on dough-making machines are taken from a lecture delivered by the writer and published by the National Association of Master Bakers. "I don't think any great advantage can accrue to the baker in the use of a machine driven by hand power. A man is himself a very defective machine, and I cannot see what appliance on a machine will husband his energy, however much it may increase his power. In other words, I don't think a man can make dough by a hand machine with greater ease than he should be able to do without its assistance: if it requires more energy in less time, or less energy at the moment but spread over a much longer time than the ordinary method of making dough, it is equally uneconomical as a machine.

Hand-driven Machines Useless.

"With regard to the power-driven machine, the less complicated it is the better it meets the requirements of the bakery. Its parts should be simple and strong, and as nearly unbreakable as possible. It should be well finished and smooth, and the parts requiring cleaning easily got at. It should not have a centre shaft, nor should the blades be subjected to great leverage when at work; it should not require excessive power to drive it, although the power installed is usually greater than what is absolutely needed. One error in which engineers for some time were involved was in endeavouring to make a machine do too many different operations. They were no doubt driven to this by the demands of bakers, but these demands were evidently conceived in ignorance of the kind of thing a machine is and the purpose for which it is intended. I have repeatedly heard men profess a preference for one machine over another, not because it actually mixed quicker or better, but because it had arms shaped something like a man's and because the motion was also somewhat similar. . . . I should consider this the very poorest recommendation a machine could have. The only thing a mixing machine should do is to mix. If it does this properly in the minimum of

Requirements of a Good Power-driven Machine.

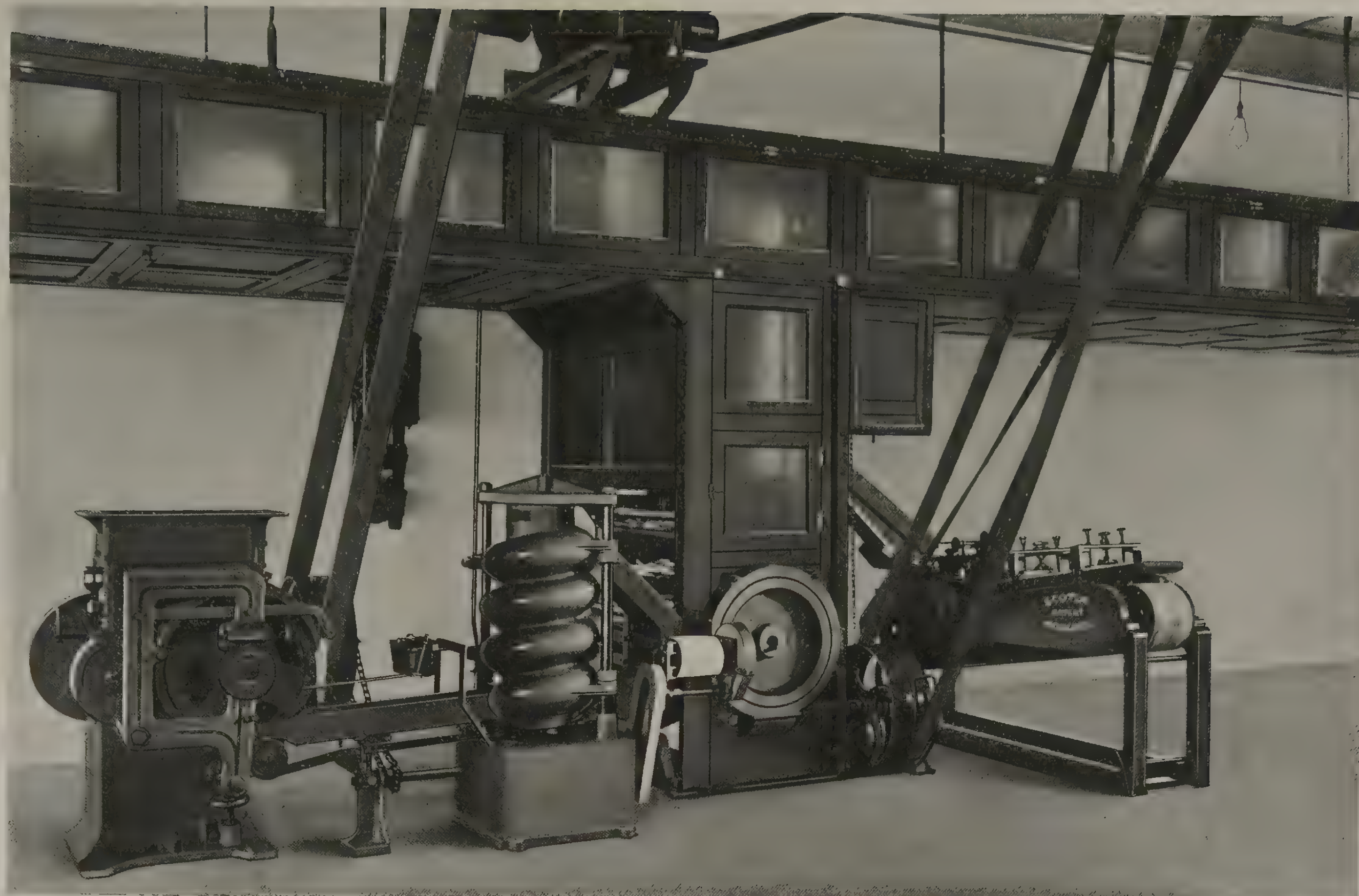
time with the least expenditure of energy, and the least strain and wear, then, other things equal, it is the ideal machine, whatever the shape of its arms or whatever its motion. If it is deficient in any of these essential particulars, then to that extent it is faulty, and the likeness of its arms to those of a man is no saving grace.

"The mixing machine that is required to 'break sponge' as a preliminary to making dough has been provided on the demand of the baker. This requires two speeds on the machine, which necessitates complicated gearing and makes the machine more liable to go wrong in working, without any compensation in improvement in the dough. Because a baker, when he makes his bread on the sponge-and-dough system, has to spend a good part of the time in breaking up sponge in the water before drawing in the flour, it is assumed that dough cannot be right unless the same process is followed in every detail when a machine performs the operation. . . . While it is absolutely necessary that in hand work the greatest care must be exercised in thoroughly breaking up sponge, because if this is not done the subsequent mixing of dough does not properly deal with every particle, and the pieces of sponge may remain as sponge to the end, the same rule does not apply to a machine, simply because it deals with the dough in minute detail, and particles of sponge get stretched and mixed as thoroughly as if they had previously been dissolved in the doughing water. . . . A machine that is a good dough-mixer is very likely to be a bad sponge-breaker, for the double reason that the open-arm arrangement best for sponge-breaking is faulty for the heavier work of dough-making, and that the centrifugal motion imparted to the sponge by quickly revolving arms is not conducive to easy breaking of wet sponge. The sponge is more likely to slip round and over the arms than to be broken up by them; while the disadvantage of having the sponge and water a long time in the machine, probably losing heat all the time, is greater than any advantage that may accrue from having the sponge broken up in the water. But better than all considerations of this kind is the fact that dough made with sponge that is simply placed in the machine with flour and water and other ingredients, and the whole thoroughly mixed together, is in all respects satisfactory dough, ferments freely, and produces a loaf of as even a texture as anyone could desire. This does not, of course, imply that two speeds on a dough machine is a needless elaboration. When both slack and stiff doughs are required for different kinds of bread, it is a decided advantage to have a quick speed for the former and a slow speed for the latter, and the power needed will be about the same in both cases."

Machines that Break Sponge.

When about to choose a machine, the selection should be guided by the number of men available to handle the dough afterwards, and by the oven capacity to bake it, for nothing so readily causes irregularity in the bread as having the batches of dough too big for the oven capacity. The piece left over, whether mixed with the next batch or baked by itself, is always unsatisfactory.

Choice of Dough-mixing Machine.



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MELVIN'S AUTOMATIC BREAD-MAKING PLANT

It is a very bad plan to have large lots of dough made with only a small staff to handle it. A very satisfactory arrangement is to make the doughs equal in every case to the capacity of the oven for the loaves to be baked in. If the staff is large, then the doughs may be made equal in size to the capacity of a series of ovens that can be filled in consecutive order in about one hour.

Methods of Machine Dough-making.

There is little uniformity in methods followed in making doughs in machines. In some establishments the practice is to sift the flour into the machine, then to start it working and let the water run in while it is being mixed. By following this plan there is a danger of stiff pieces of dough being formed which require afterwards to be softened down with the water subsequently added. The opposite method is followed in other bakeries. The water is let into the machine first, then the flour is sifted on top of it. This plan is likely to be less troublesome than the other, because the dough is mixed first into a soft paste, becoming of gradually increasing stiffness as the flour is sifted in. This method produces a smooth, well-mixed dough. Care has to be taken, however, that the machine does not cool the water overmuch before it is mixed into dough, as it readily may if the mixing is delayed in any way. The most satisfactory method is to sift flour first into the machine, then to run in all the water and all the other ingredients before the mixing is started, and then to mix all at once.

Cost of Machinery.

The competition amongst engineers has now become so keen that a serviceable installation of machinery suitable for a trade of forty sacks, and with a cake and sponge machine, can be procured for about £400, and if reasonable security is available bakers are able to obtain machines on hire or on the hire-purchase system. The running expenses of such a plant, working up to full capacity, would probably not be more than 10*s.* a week. When the baker has decided to obtain machinery, his great difficulty is in making a selection from amongst the many varieties of machines he is offered. For many years the prime favourite in the matter of machines was that patented about 1885 by Mr. Paul Pfleiderer, and called by his firm the "Universal" because it has been adapted for mixing all sorts of ingredients besides bread (see figs. 217 and 218). It is sold in various forms for mixing pills, cordite, rubber, cement, &c. It seems to be equally effective for all purposes, whether the ingredients are wet or dry, soft or tough. Its original purpose, however, was that of a dough-mixing machine, and it very early established itself as a thoroughly efficient appliance, although its comparatively high cost on account of its substantiality prevented its adoption by the smaller bakers. As the patents for this machine have run out for several years, it has been very largely copied by other makers. The main points of this machine are that it consists of two cast ends, round which a sheet-iron half-drum is riveted. The internal mechanism consists of two blades twisted **Z**-shape at varying angles,

The "Universal" Dough-mixer.

but made so that as they revolve they are close to the interior of the drum, carrying the dough round with them, and cutting and pressing it between them as they meet in the centre of the drum, or shearing it between them and a ridge in the centre, which really acts as a third blade. The bends on the blades are of different lengths and they are geared to run at different speeds. The effect of these conditions is to shift the mass of dough backward and forward in the machine and to carry it as well from one end to the other until the mixing is thoroughly done. This machine works slowly, yet a dough is very efficiently mixed in from eight to fourteen minutes according to its size. A machine on the same principle is made with only one blade for small doughs. In this case the sides of the drum act as the holding surface, against which the single blade cuts and mixes the dough. The power is applied to the machine by two pulleys, one with a straight the other with a crossed belt. Either can be made fast to the working parts by means of a friction clutch, so that the machine can be run forward or reversed. This arrangement is extremely useful and expedites the mixing. Thus, after the machine has been running forward for some time, the blades may retain around them some dry flour which is carried round without mixing. The blades are immediately cleared when they are reversed, and the previously imprisoned flour is scattered over the dough and thoroughly incorporated. On account of the blades of this machine being broad and blunt, it has been suggested, wholly on theoretical grounds, that it is likely to "fell" or unduly solidify the dough; but in practice, as the writer can vouch from a lengthy experience, there is no damage whatever done to the dough. Although, for the reason already given, it takes a little time after dough is made before it shows active signs of working, yet the fermentation is proceeding all the same, and the dough afterwards becomes free enough and produces bright-looking loaves with a fine texture. All sorts of variations have been introduced in the shape of the arms of the machine and in their mode of motion, but there is nothing quite dis-

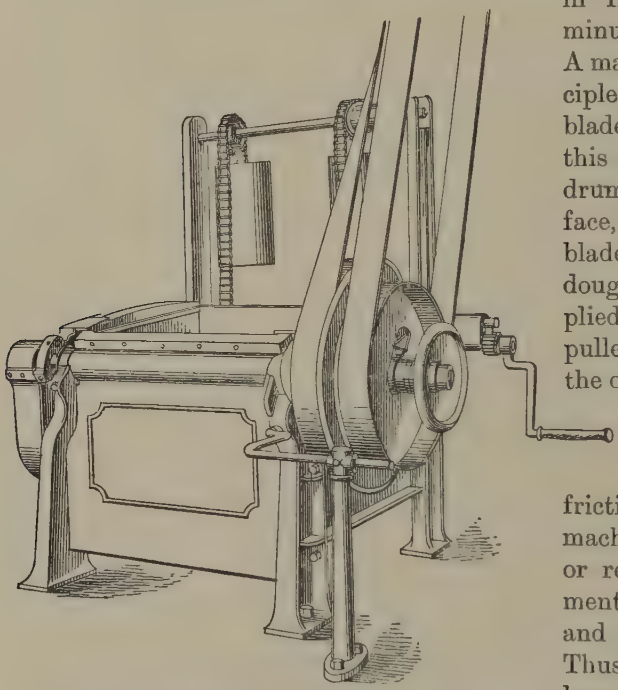
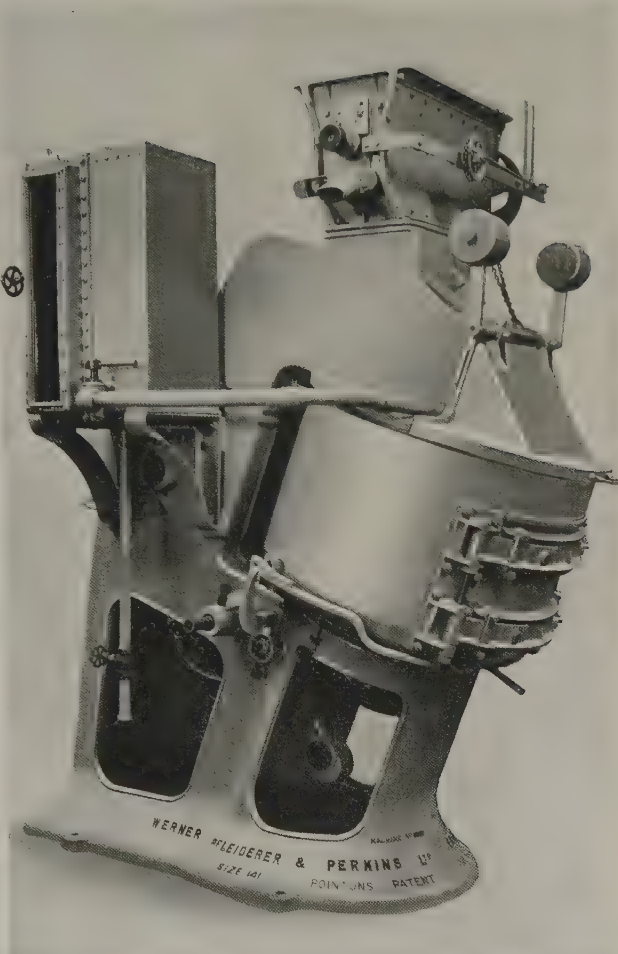


Fig. 217.—"Universal" Dough-kneading Machine



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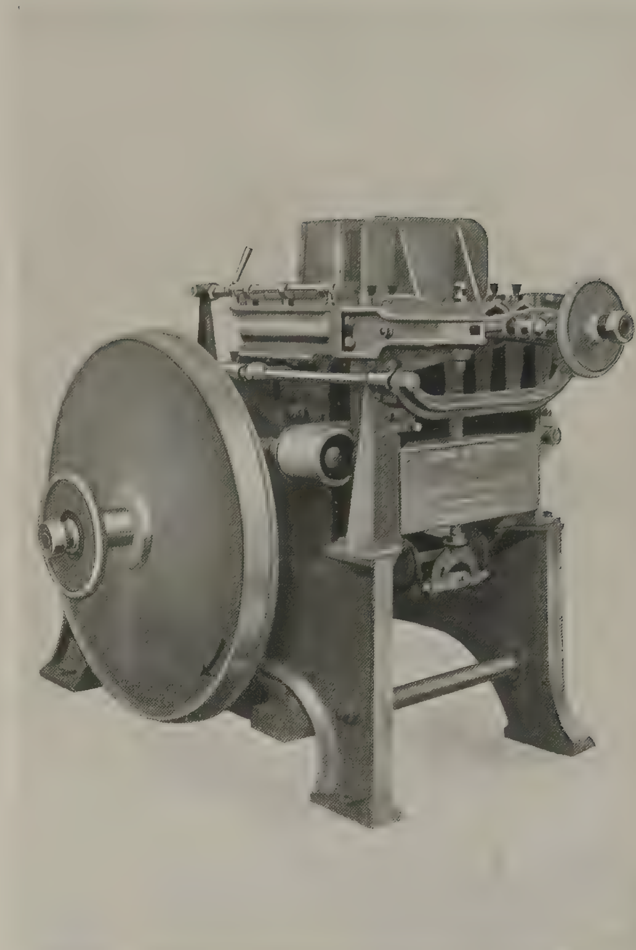
"VIENNARA" KNEADER, WITH SIFTER AND TEMPERING TANK



FOUR-CYLINDER DOUGH-DIVIDING MACHINE

tinctive in the principle of any of the machines to warrant special notice.

The "Viennara" Machine.

Quite recently a machine on a new principle has been introduced called the "Viennara" (see Plate). This is a cylindrical machine fixed at an angle, and with one strong arm with a sort of branched or forked head. The drum or cylinder of the machine revolves while the dough is making, and at the same time the arm plunges down into the mixture and then lifts or pulls a portion of it upwards and folds it over; the double action of revolving drum and the lifting arm ensures that every portion of the dough is thoroughly mixed and toughened. The toughening part of the process is so complete that on account of it a much larger quantity of water is required to hydrate the gluten of the flour, and the yield of bread is in consequence much increased. It is claimed that this machine forces a greater water absorption and therefore an increased yield besides much improving texture. Within the last few years there has been a growing favour toward lighter machines. There are several varieties with the features in common that they have an open revolving pan with one or two arms working in such a way as to clear the bottom and sides of one part of the pan after another as it revolves. These machines are effective dough makers, and are comparatively cheap. In some cases, however, although the pan can be removed from the blades the dough has to be cut out into trucks. A few are made to tilt (see Plate).

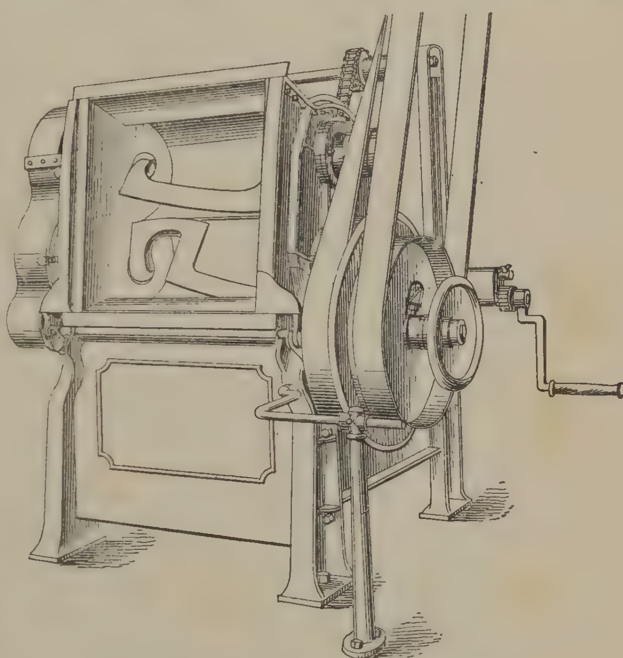


Fig. 218.—"Universal" Kneading Machine, Tilted

German Dough-making Machine.

In Germany, Belgium, and the United States there is a dough-making machine in considerable favour, which consists of an ordinary movable iron trough with a round bottom, into which a revolving arm can be turned. This arm revolves slowly backwards and forwards until the dough is thoroughly mixed. When this is accomplished, the trough part of the machine can be turned away for the dough to prove, and another empty trough placed in position under the arm for

another dough to be made. Fig. 219 shows this machine, with the trough part moved out of the position it occupies when dough is being made.

The dough-making machine which has within the last few years found much favour amongst small bakers is what is known as the Drum machine.

The Drum Dough-making Machine.

This was originally the invention of an Irish baker, Mr. Adair, and consisted in its original form of a large round drum fixed at one end of a strong arm or shaft, but without any movable arms internally. The ultimate developments in this machine consisted in having two cast-iron ends to the machine with spindles, and these supported

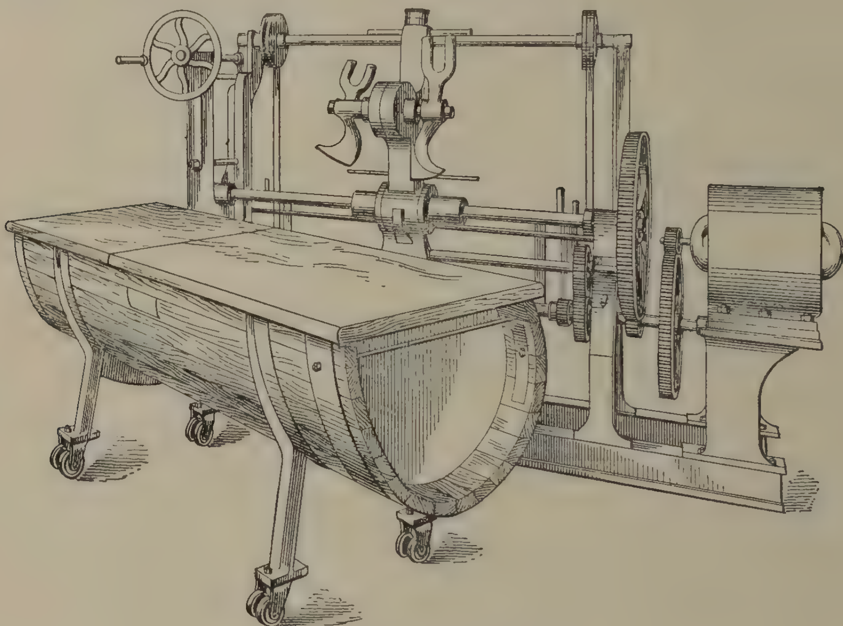


Fig. 219.—German Dough-mixer

on A-shaped legs. These machines originally had two doors fixed on the circumference opposite each other, but the newer type has only one opening, closed by a lift-off door with effective water-tight packing. It has no moving parts whatever, but three, four, or more iron rods are bolted across the machine, and over these the dough is cut or broken as it is carried round by the machine. The revolutions of the machine are very slow, about fourteen in a minute, and at each revolution, as the dough mixture is carried to the top of the machine, it drops across the rods; and as this operation is repeated over and over again, a complete admixture of all the parts takes place. In some machines, instead of single rods fixed across the machine, movable grids are used. The effects are similar to those obtained with rods only, and it is doubtful if the alteration to grids is any improvement. Those who are unfamiliar with this type of machine have an idea, evidently because the doors are comparatively small, that the machine is difficult to clean. The writer is practically familiar

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4-CYLINDER DIVIDER, FLEXIBLE HANDER-UP, PROVER, AND FLEXIBLE MOULDER

with this machine, and can assert that it is really easier to clean than a machine with arms. The dough can be made perfectly in this machine, but one of the drawbacks attached to its use is the difficulty of examining the dough from time to time as it is being made. This, however, is not wholly a disadvantage, since it forces the baker for his own sake to calculate nicely the quantity of flour and water he should use for each dough, and makes him also very careful in his weighings and measurements. Fig. 220 shows a modern drum machine with internal grids and a patent clutch for starting and stopping.

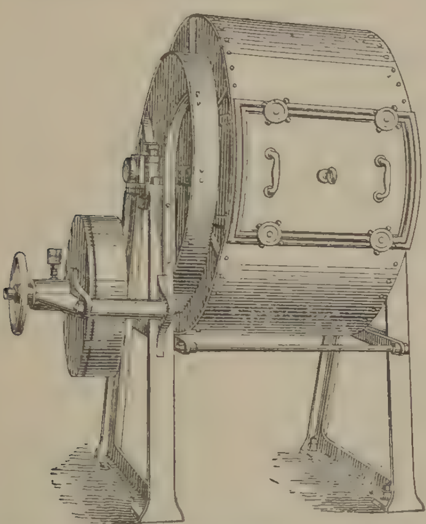


Fig. 220.—Hawkins Rotary Dough-making Machine

Bread-dividers.

Up to about a dozen years ago the whole machinery in even a large bread bakery consisted of one or two dough machines with tempering tank attached for water and sifter for flour. In Scottish bakeries there may have been a dough brake and a sponge-stirrer also. The next development was in the matter of bread-dividers. The first type of divider was on the same principle as the older and familiar bun-divider. A weighed quantity of dough is spread in a square iron box; a presser or plunger descends and presses the dough and spreads it to fill the box; then knives descend through the presser and cut the dough into an equal number of pieces of the same size. There are still a few of those machines in large bakeries, and with care they give moderately good results. There are now, however, several types of loaf-dividing machines on the market. The general principle governing all of them is that the dough is measured rather than weighed. The dough by means of plungers is pressed into receptacles, a given thickness of dough presumably weighing a given amount. In practice these machines turn out pieces extremely near the proper weight, and with almost perfect regularity. For dough of any stiffness the length of aperture for the measurement of the dough is determined by a screw gauge, but if the stiffness of the dough is altered it may be necessary to alter the gauge slightly to suit the alteration in the gravity of the dough. These slight alterations can be adjusted very easily, even when the machine is working. The same sort of adjustments must be made when the weights of the loaves are altered. In all these machines the dough is measured—not weighed—in a box or cylinder, and ejected from it by a plunger which fits quite close but free. In some types of machines the cylinders are comparatively long and with a diameter about 4 in.; in others the cylinders are larger in diameter—about 6 in.—and of course much shallower. In the original divider

a receptacle at the bottom of the hopper is filled with dough by the weight of the latter only; then a knife-edged plate cuts off the dough in the hopper, and an accurately fitted plunger pushes the dough in the receptacle underneath into the measuring boxes, the plungers of which recede before the dough until they reach the stops, which are fixed in position by the gauge already referred to. The frame containing the boxes with the measured dough then descends, and a cross arm pushes the plungers until they are flush with the inner ends of the boxes, the pieces of dough being dropped on to a band which conveys them on to or along the table. Once the machine is nicely adjusted, the pieces of dough are very uniform in weight. One difficulty that sometimes arises is when any slight obstruction occurs in the measuring boxes. The plunger is so accurately fitted that a very little piece of hard dough is sufficient to cause it to stick, with the result that the loaves from that particular box may be more or less short weight. The plunger which first clears the receptacle under the hopper is not fixed to any rigid arm of the machine, but the pressure to which the dough is subjected is determined by a weight, or rather a box of weights, hung on the lever that works the plunger referred to. The idea is to subject the dough to sufficient pressure only to fill the measuring boxes and no more, that the dough may not be "felled" or damaged in any way by excessive pressure.

The Original Dough-divider.

In another type of machine the box under the hopper is cleared and the measuring boxes filled by a conveyor screw which pushes the dough forward; but here again the screw conveyor does not exert a rigid pressure, but only sufficient to fill the boxes, because it is fixed at the end on two spiral springs, and according as these are adjusted to be very open or close, the pressure they exert will be very gentle or very hard. In one type of machine the measuring boxes are in the circumference of an iron drum, the pressure on the dough to fill these boxes being exerted by rollers. In some machines the boxes are necessarily kept clean only, and to prevent rust have to be thoroughly cleaned and greased after each time of using; in other machines an automatic lubricating arrangement is attached to the measuring boxes, so that a thin film of oil is spread over them to prevent the dough sticking. In spite of all expedients there is some difficulty in getting these machines to work satisfactorily with very soft doughs. The machines have been accused of "felling" the dough, and it does seem to require more time to recover after being through such a machine than when handed up in the ordinary way. But although the writer has had practical experience of several types of dividers he has not found any permanent injury to the dough from their use, although mistakes in adjustment of the weights, or of the pressure springs, sometimes produce excessive pressure that makes the dough feel dead for a time; but a reduction in weight to actual needs, or opening the springs, is sufficient in either case to effect the desired remedy. Overripe doughs damage easily.

Other Types of Dividers.

The latest development in connection with dividers is to attach directly to them an arrangement for "handing up" the loaves and delivering them

quite round, ready for boarding or for the prover. This hander-up consists essentially of a wheel with a deep groove in which the pieces of dough run, pressing against a band of felt or other material. When dividers were first adopted the accepted idea was that a short time should elapse after the loaves were divided, before they should be "handed up"; but now it is recognized that the time to allow for recovery is between the handing up and the moulding stage. In some systems the "handing-up" machine is quite distinct from the divider, but the latter delivers its pieces directly on to the former. One of the first and best-known type of handing-up and moulding machines is shown in fig. 221. This consists of a wide metal corrugated cone which revolves, and there are fixed above it metal channels or troughs held in position by springs, the tension of which can be increased or relieved as desired. The pieces of dough enter these channels near the outside edge of the cone, and as the latter revolves they are carried forward and upward by the aid of the corrugations and the surface of the covers, and in the passage are rendered round and smooth. As the covers are not rigid, but yield on account of the springs to the pressure of the dough underneath, that dough is not unduly pressed nor its skin torn. In the early machines of this type each size of loaf had to have a special size of cover adjusted for its moulding, the separate covers being taken off or fixed on the machine as needed. Pointon's new flexible moulder has no large cone table, but a travelling band formed by metal laths mounted on chains supported on chain wheels. The moulding troughs are arranged on this band diagonally, and by shifting the angle of the band, or opening or closing the trough by hand wheels, small and large pieces can be moulded without the use of different troughs.

Handing-up Machines.

Handing-up and Moulding Machine.

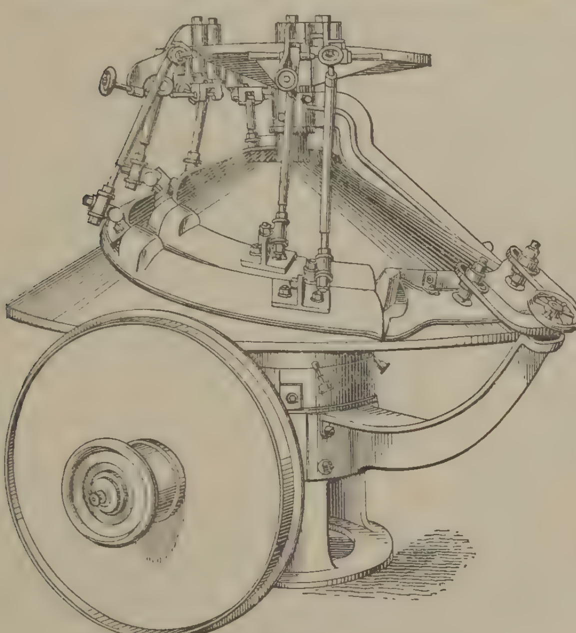


Fig. 221.—Bread-moulding Machine

When a piece of dough had to be made only into a round ball having the texture of the interior fairly even, there were mechanical difficulties which engineers have quite overcome. Even pan loaves, shaped like cylinders at the dough stage, although more difficult to mould, have been successfully

manipulated by machinery. In recent years experiments with moulding machines have been continuous, and practically in all directions. Thus such difficult materials as soft doughs for Scottish morning rolls and batch bread seem quite unsuited for mechanical treatment; and among Scottish operative bakers there was a settled opinion that, however easily moulding machines might be adapted for English crusty loaves and pan shapes, reliance must always rest on trained operative bakers for moulding Scottish varieties. This prejudice has had to be abandoned. There is a highly efficient machine now producing morning rolls, even to wetting their surfaces after moulding. There are several loaf-moulding machines for Scotch bread.

A machine specially intended for moulding tin or long loaves is shown

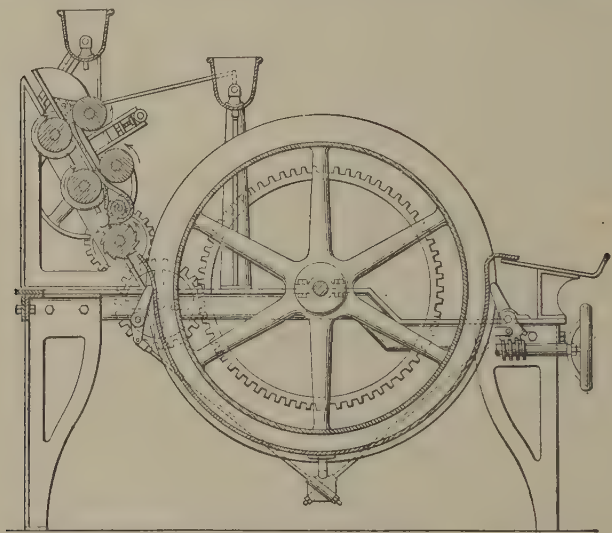
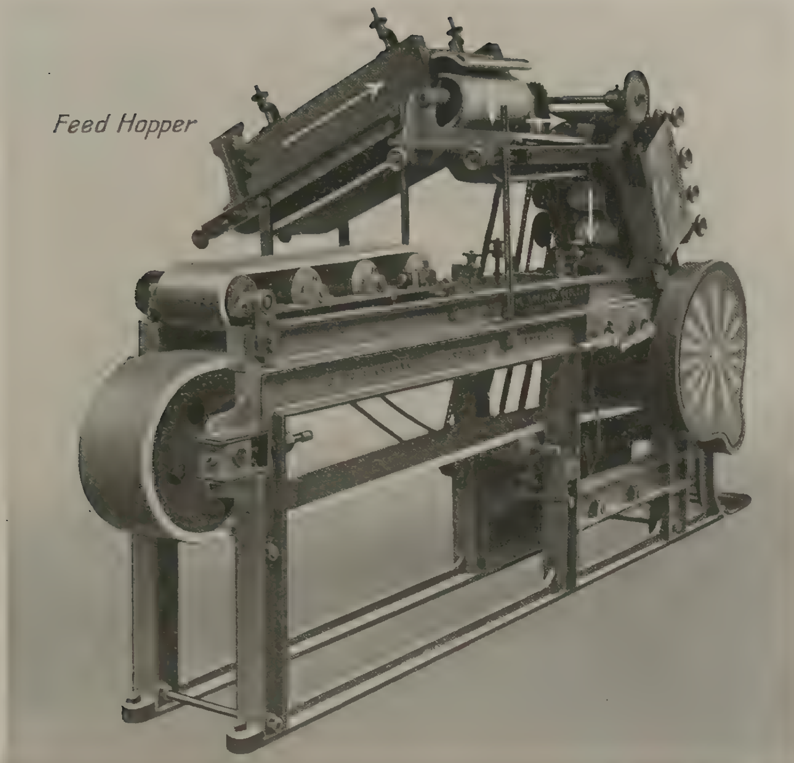


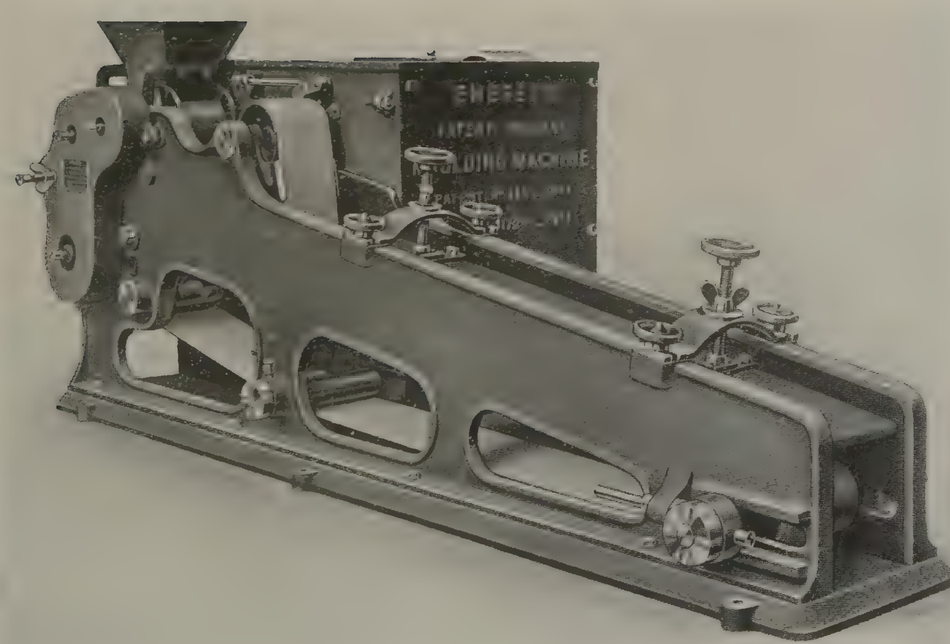
Fig. 222.—American Moulder

Moulding Machine for Long Tin Loaves.

in sectional elevation in fig. 222. In this machine the piece of dough is first conveyed between series of rollers and drawn out into a long band of dough of uniform thickness; then as it is carried forward in the machine, this band is rolled up quite gently but firmly, and delivered directly into the tin placed in position to receive it. This machine is more common in America than in Britain, but the writer has had some experience of its work, and can vouch for its efficiency as a moulder of soft dough, producing loaves of quite remarkable evenness of texture. There is a type of moulding machine, of continental origin, which performs the double operations of cutting out and moulding in quick succession; but only in round shapes suitable for cut rolls, buns, &c. A more elaborate British appliance, called the "Rollin Moulder", turns out pieces in baton shape or rolled-out oval. There are several types of "spindle" machines, of which Embrey's Moulder (see Plate) was the pioneer. In one machine, for English tin bread, there are fluted, revolving, and recipro-



LOTHIAN MOULDER



EMBREY'S MOULDER

cating spindles, for spinning up the loaf after it has been proved, and then shaping it between parallel travelling bands, ready to drop into the baking tins. A machine called a "Scotch Chafer" (see p. 52) is an elaborate piece of mechanism, in which the loaves are dealt with automatically as they come from the prover. They are sheeted and folded, first in one direction and then upon an axis at right angles to that of the first fold. The result is identical with that imparted to the loaf by hand "chafing". Other types of machines for dealing with Scotch batch bread obtain the cylindrical shape and smooth skin by sheeting the dough, then rolling it between travelling bands running in same direction at different speeds (see Plates).

Room for Invention.

The ideal of the factory baker and of the bakery engineer is to produce a combination of machines that will make bread almost without any handling of the dough. The series of mechanical contrivances are not yet fully provided, although one difficulty after another has within recent years been overcome. Something is still needed in place of the very old-fashioned method of tipping dough into a wooden truck, allowing it to prove there, then cutting it out into small pieces at a time, and lifting it by hand into the hopper of a dividing machine. Some improvement is also needed towards making the setting of the bread in the oven more of a mechanical operation, and improvements are needed in appliances for drawing the bread and conveying it to the packing store, although in large establishments automatic conveyors are provided for this purpose. But from the time the dough is placed in the hopper of the divider until it is arranged on the "setters" to prove for the oven, the process of breadmaking may now be considered as practically automatic. There are now a number of "systems" of automatic baking. The flour may be previously blended and stored, then actually weighed by an automatic weigher, that registers the amount, into the mixer. The water, carefully mixed in a special tank and the temperature adjusted, is measured into vessels containing the salt and the yeast respectively, or into a ferment tub with the yeast and yeast food. The dough is kept in trucks till it is ready, and is then passed in pieces into the divider; from this it is divided without handling on to the "hander-up" and then to the prover, which is a large enclosure with hanging cloth-lined trays that are carried very slowly and with an intermittent motion upwards and downwards through the prover until they reach the aperture on the opposite side, at which they are automatically turned on to a band by which they are conveyed to the moulder; after moulding, the loaves are placed on the "setters" to prove. All the machines working thus together have to be speeded so that the loaves pass along in a continuous stream without congestion. In the prover the shelves are cloth-lined, so that no dusting is needed to prevent the loaves from sticking. At an ordinary bakehouse temperature the loaves can remain long enough in the prover to mature properly, but there are many bakeries in which the temperature is too low to attain this without artificial heat. As the prover is entirely closed in, and is therefore free from draughts, the upper parts of the loaves, although uncovered, do not readily skin, even if the air is com-

paratively dry, or only moist by the slight exhalation of vapour from the loaves themselves. But when extra heat is needed it cannot be obtained by the use of naked steam, because that, if present in any appreciable quantity, would make the loaves stick to the cloths, and would otherwise damp these and render them clammy. But in the latest appliances water or steam radiators are fixed near the bottom of the prover, so that, should occasion arise, their atmosphere may be raised to and kept at any desired temperature. The intermittent movement of the shelves of the prover is to allow time for each shelf to be filled with loaves while opposite the long narrow opening that serves for this purpose. This type of prover (see the Plate) is high, and rises like a great oblong box from the floor level.

Baker, Sons, & Perkins Automatic Plant.

A type of automatic plant now operating in many large bakeries is that supplied by Messrs. Jos. Baker, Sons, & Perkins, Ltd. As part of the outfit there is a flour-blending appliance, which enables the storeman to mix the flours required in accurate proportions of the different sorts. The flour, after blending, may go to store bins, connected directly with the weighers and mixer, or, if such conveniences are not available, may be resacked until required for use. The plant includes appliances for weighing automatically flour and water directly into the dough mixer. After mixing, the dough may be tilted into trucks, and allowed its due time to ripen. In some cases trucks are not used, but the dough allowed to prove in the pan. The mixer consists of a large pan with lid that may be wheeled away from the mechanical part of the machine. When it is "ready", it is passed in pieces to the "divider", where it is made into pieces of any desired size, and, without handling, passed on to the "hander up", and from that machine automatically to the "prover." This is a larger draught-proof enclosure with hanging cloth-lined trays, which are carried very slowly, and with continuous motion, upwards and downwards through the prover until they reach the delivery end. Here the pieces are turned automatically on to a band by which they are conveyed to the moulder. The speed of the band and the speed at which the moulder is working can be accurately adjusted, so that there is no congestion at any point, and the pieces move along in a continuous stream without attention. After moulding, the loaves are placed on the "setters" to prove, or, if tin bread, are hand fed into an automatic final prover, which is self-contained with a travelling oven of the "swinging-tray" type.

Oven-loading Conveyors.

There are now two systems of automatically loading ovens: that of Messrs. Baker, Sons, & Perkins referred to above, and that made by Messrs. Cox & Son (see Plate). This appliance is adapted for tin bread, and is in use in a large Manchester bakery. A frame with apertures, each to hold one pan, is suspended from chains, and by an overhead rail the frame and full pans can be conveyed above the drawplate of the oven and deposited on it. The chains are detached and the frame left on the plate while the bread is baking. When the batch is ready the chains are again fixed to the overhead trolley, and the whole batch carried at once to the cooling and packing room to be emptied. The whole opera-

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FLOUR HANDLING OUTFIT

tion of loading or unloading a plate occupies only a few minutes, and as the pans are equidistant from each other the baking is very uniform. This arrangement is evidently not suitable for crusty bread. It is suitable for a bakery with large output of one type of bread.

Some ingenious bakers have designed and had built quite effective conveyors. The writer has intimate knowledge of two such appliances, both in London, but in bakeries now discontinued. In one case the loaves from the oven are packed by hand on flat boards—the same number on each board—and these are placed on hanging shelves of a chain conveyor in continuous motion, which carries them directly to the packing room, where an attendant transfers them at once to racks ready to be packed in the vans. The other form referred to is an ordinary band conveyor in a casing with sides, and running near the ceiling. The end of this long conveyor reaches near the ovens, and can be lowered to any convenient height to receive the loaves as they come from the oven. They are drawn from the plate on to a large table, then simply placed on the conveyor by hand and carried a considerable distance away to the bread room. This conveyor is very efficient. It reduces the labour in the bakery and saves space. The adoption of conveyors of some kind for carrying both bread and tins of confectionery from the front of the oven to a more convenient packing place is a development likely to proceed at an increasing rate in the future. Now that electric motors are coming into such general use, even in small bakeries, there is no reason why a conveyor should not be a necessary appliance in every factory claiming to be up to date.

Conveyors for Unloading Ovens.

It is always a matter of surprise that an inconvenient and extremely wasteful arrangement for handling newly-baked goods will be persisted in for years, because there is a little trouble in making a change, or an outlay of a few pounds. If bakers would exercise only a little ingenuity, they could, in most cases, rig up a lift or a conveyor appliance that would amply serve their purpose, even if it had not the finish of one put up by experts. If a hand-power appliance is required, any sort of large wooden wheel with a wooden drum attachment built on two circular pieces round the axle serves as the hoisting arrangement, suitable either for a single or a double lift. The chain or rope to the lifts is wound two or three times round the barrel or drum, in the same fashion as sailors wind a rope round a windlass; then the rope goes over a guide pulley to the cage. If there are two cages, the rope is not fixed to the drum, but one end goes to one cage, the other end to the second one. The large wheel has V-shaped pieces of iron screwed on the outside of its rim, over which is an endless rope hanging down to the bakery or at some convenient place near it, and this rope can simply be pulled by hand to operate the lift, or it can be fixed over a grooved wheel of convenient size and worked by a handle. The V-shaped irons on the lifting-wheel hold the rope very tightly, and give all the power necessary with the minimum of frictional loss.

Home-made Lift.

CHAPTER IV

CONFECTIONERY MACHINERY

The machinery applicable to confectionery manufacture is as a rule smaller and lighter than that for bread. In large factories, such machines as those for making fondant, grinding almonds, or even grinding sugar may be profitably installed; but as confectionery, except cake-making, is still, and likely to remain, unsuitable for factory operations, the machine plants in use will continue to be comparatively simple. Sponge-beating machines are invaluable, and can be used for sponge goods or for beating whites of eggs for meringue, &c. There are four distinct types of those machines on the market, any of which is quite satisfactory if handled properly. The Morton machine has series of oval grids which pass through each other. It has a circular bottom, generally of copper, and is jacketed so that it can be heated up with warm water. The Griffith machine has two sets of vertical grids. The Geddes machine has a frame consisting of circular ends with steel bands stretched between them, alternate sets working in opposite directions. The Cadisch whisk (fig. 223) is intended to work exactly like hand beating. It consists of a copper pan fixed in a ring. The whisk is a long wooden handle with a bulbed head of wire. The handle of the whisk is fixed with a pin to a movable support, and the top end turns freely in a ring connected with a spindle which has a small flywheel at its top. Cone gearing allows for using either slow or quick speed as desired. Some confectioners are specially fond of this machine, but the writer cannot see that it is more effective than the others, and it certainly needs a good deal more repairs for broken shafts, and more care in adjusting to get good work from it. Some sponge machines can be fitted with arms for cake-beating. Although great care has to be used in working with these different sets of arms alternately, to prevent the sponge mixtures, say, from being spoiled with the fat from previous cake-mixing, yet for anyone with only a small trade the double-purpose machine is a boon, saving space and expense, and giving all the efficiency desired.

Confectionery Machines.

Sponge-beating Machines.

Cadisch Whisk.

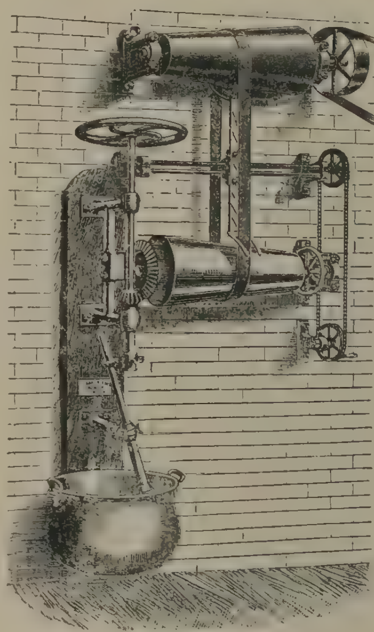
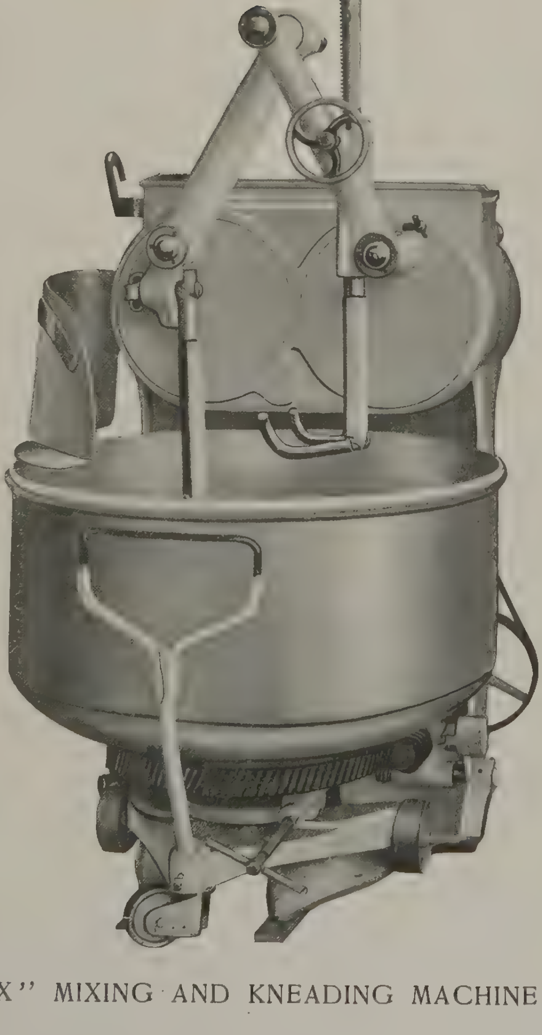


Fig. 223.—Cadisch Whisk (old style)

"ARTOFEX" DOUBLE WHISK



"ARTOFEX" MIXING AND KNEADING MACHINE

Of cake-making machines there is an endless variety. Like dough-making machines, those that are simplest in construction are most satisfactory. Although, as already stated, it is a convenience when the whisk and the cake-batter blades can be used alternately in one machine, it is more satisfactory, when there is sufficient work to do, if the cake-beating blades are fixtures. Fixed blades are more difficult to clean, but movable blades are always in danger of getting out of order through faulty adjustment. Whatever kind of cake machine is used it ought to have two-speed gearing—a slow speed to start the mixing of butter and sugar, &c., a quick speed to beat them to a cream, and a slow

Cake-making Machines.

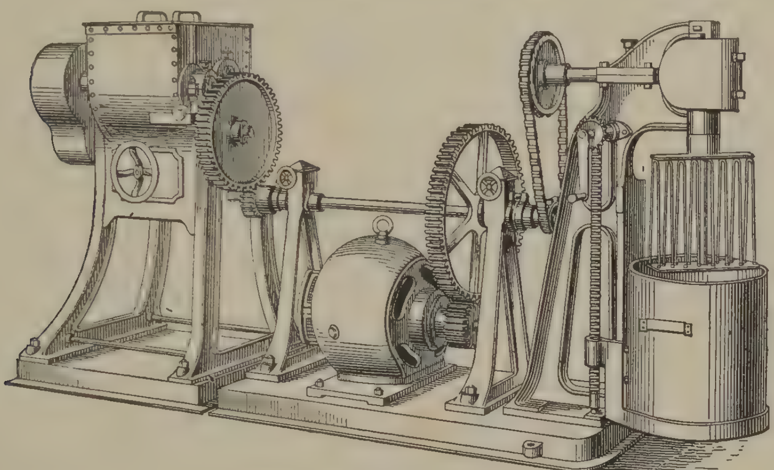


Fig. 224.—Small Cake Plant with Motor

speed again to mix the flour, fruit, &c. Great developments have taken place in connection with cake-beating machines within the last twelve years. The impetus has come principally from the United States: the Cadisch whisk principle has been elaborated and the appliances, American and English, made more compact and effective.

In addition to the usual run of machines there is one little machine, an illustration of which is given on the plate at p. 188, Vol. II, that is most useful to the confectioner. This is a disk cutting, grating, and slicing machine. The cost of a small one is about 45*s.* With this four disks are provided. These will prepare almond meal, shred almonds, chop almonds, or slice peel for the inside or outside of cakes, slice vegetables, make cake or bread crumbs, &c., &c. A small cake plant, as shown in fig. 224, is efficient for doing a very considerable shop trade, and, quite as much as in the bread department, machinery, for the harder work of the confectioner, increases his capacity many fold.

Almond Cutting, Grating, and Slicing Machine.

CHAPTER V

POWER—GAS AND OIL ENGINES

Machinery in the confectionery side of a bakery may be a great labour-saving agency even when it is driven by hand; but in a bread bakery, although hand machines may be cleaner than hand work, and perhaps even less exhausting, the scope of such machines is very limited, and the saving they effect cannot be very great. Happily, power is not very expensive, either with regard to the machine for its application or the material that supplies it. Gas or oil engines are suitable for bakers' use, because they can be obtained small enough to be cheap, and with just sufficient power for the baker's requirements; because they require little skill to work them; because the construction is so simple that there is little danger of breakdowns or much cost for repairs; and because they can be started quickly and stopped immediately the work is done, and at a very small cost for gas or oil, with practically no waste. For a two-sack machine of any type a gas engine of four horse-power nominal is sufficient to supply the necessary power, while one of the drum machines of the same capacity may obtain sufficient power from an engine of two horse-power. The gas supply to the engine is received from the main into a cast-iron casing, with a sheet of indiarubber for the back. When this casing, or bag as it is called, is full of gas, the distended rubber automatically shuts off the gas supply, and admits gas again when some is drawn into the engine. The piston of the engine, to which uniform motion is conveyed by the connection with the flywheel, acts as a pump at the first part of its outward stroke, drawing in to the cylinder a mixture of gas and air; then, as the flywheel pushes the piston back it compresses the gas mixture in the cylinder, and a small quantity of gas passes through a small aperture into what is called the combustion tube. This is a porcelain tube surrounded by the flame of a Bunsen burner and maintained at a bright-red heat. As soon as some of the gas enters this ignition tube it is ignited and explodes the whole of the compressed gas and air in the cylinder, thus exerting a great pressure on the piston, which in turn is conveyed to the flywheel, which acts as a sort of reservoir of energy, paying it out as work again at a uniform rate. As the explosions in the cylinder produce a great deal of heat, it is jacketed and connected with a large cistern of cold water, which provides for the circulation of cold water round the cylinder while it is working.

Gas Engines in the Bakery.

The cycle of actions in producing the power in a gas or oil engine are: (1) the piston draws in a mixture of gas and air at its outward stroke; (2) the return stroke compresses this mixture with a pressure of about 40 atmospheres; (3) the mixture is ignited and explodes, and the impact projects the piston forward; (4) the return

Action of the Gas Engine.

CONVEYOR SYSTEM FOR LOADING AND UNLOADING OVENS

stroke of the piston removes the residual products of the explosion from the cylinder. All these movements are properly regulated by valves, which are geared to work automatically. The governor of the engine, which prevents its reaching too high a speed, consists of two balls with a weight on top. The rod carrying these balls has a collar on it fitted in a sleeve, which is connected with a small rod carrying a crosspiece which acts as a bridge between the gas supply and the valve allowing entrance to the cylinder. This governor does not regulate the gas supply, but cuts it off completely whenever the engine runs at a speed higher than that for which the governor has been set. When the speed becomes too high the balls of the governor are thrown outwards and the small crosspiece is lifted up, so that the gas valve and the opening to the cylinder are not connected, and no gas enters until the speed is reduced to the normal again and a fresh charge of gas is admitted.

Working of the Gas Engine.

In the instructions for working the engine a position is shown to which the pointer of the gas tap has to be turned to admit a larger charge of gas than is required after the engine is running; but as all gas is not of the same composition, the best explosive mixture does not always require quite the same proportion of gas to air, and in consequence the point on the disk to show where the pointer should be, has sometimes to be varied from that shown by the makers of the engine. This, however, must be determined first by experiment, and may vary considerably for different localities. The engine is started with the exhaust partly open. When the engine is to be started, care should be taken that the lubricators are all in order and filled with oil. The lever to open the exhaust should be pushed towards the flywheel when the machine is being stopped at last time of working. The ignition tube has to be lighted about ten minutes before it is required. The gas supply is turned on, the flywheel turned once backwards, then forward as many times as necessary until the first explosion takes place. The connecting piece between the gas valve and the valve to the cylinder has to be fixed in position, so that a supply of gas is admitted at every stroke until speed is obtained; then the governors automatically regulate it afterwards. When about to stop the engine, see that the driving belt is on the loose pulley; turn off the gas supply, and push forward the lever opening the exhaust. With care and very little practice, gas engines can be made to run very safely and regularly.

Oil Engines.

Oil engines are serviceable for power supply in bakeries in country districts where there is no gas supply, or where the gas is very dear, and they are quite efficient and economical. The sort of engines suitable for bakery use are those burning ordinary commercial petroleum and lamp oils. These oils are less dangerous in use than gasoline or light petroleum, as they do not give off inflammable gases until a temperature from 86° F. to 120° F. has been reached. The explosive mixture in this case consists of the vapour of the oil mixed with a definite quantity of air. The method of utilizing the force of the explosion is

not very different from the arrangement in a gas engine, but in oil engines an additional appliance is needed to produce the oil vapour from the liquid. In different types of engines the method of doing this varies considerably. In the Brayton engine the gases are burned under pressure. It has two cylinders, one for the compression of the mixture, the other the working cylinder. In the course of the compressed air a space is formed in which are packed absorbent materials, such as hemp and felt, and a special pump is provided to keep them constantly soaked with the oil. The oil carried by the porous mass of felt is blown into foam by means of a jet of compressed air. In the passage through the felt the air becomes charged with a cloud of oil globules in a condition suitable for combustion in the cylinder of the engine. During the first third of the stroke the mixture of air and oil in an atomized condition is admitted to the working cylinder, and after the firing of the charge the piston is driven to the end of its stroke by the expansion of the gases. Exhaust of the waste products takes place throughout the return stroke, and as the Brayton engine is double-acting, a similar series of operations takes place on the other side of the piston. In nearly all types of oil engines the heating arrangements for firing the charge are quite different from those adopted for gas engines. In some cases an electric spark is used, but as a rule the heat is supplied by the residual heat from the explosions in the cylinder keeping the igniter at a sufficiently high temperature, although it has to be heated up from outside sources at the start.

Ignition Methods.

In the Hornsby engine any commercial oil can be used. The base of the engine is made to serve for the oil supply. A special portable oil lamp at the end of the cylinder serves to heat the vaporizer when starting the engine, and about ten minutes are required with the oil flame to produce the necessary temperature; then, when the engine is working, the residual heat keeps up the temperature and the lamp can be extinguished. The vaporizer is connected to the cylinder by a small pipe, through which the air in the cylinder compressed during the return stroke of the piston is driven; the chamber is thus filled with compressed air. Towards the end of the same stroke the exact quantity of oil required to form an explosive mixture is injected into the chamber by means of a pump. Rapid and complete vaporization of the oil takes place as soon as it is injected into the compressed air, and the mixture in contact with the heated walls of the chamber immediately explodes.

The Hornsby Oil Engine.

The Crossley oil engine in appearance very much resembles the gas engine made by the same firm. It has, however, a special type of vaporizer, which enables a combustible mixture of air and oil vapour to be used instead of coal gas. The vaporizer consists of a chamber divided by vertical walls into four canals; through these a lamp flame passes to the chimney at top, whilst encircling the lamp chimney is a spiral passage through which a stream of air is forced. This heated air afterwards comes in contact with the oil, a portion of which is

The Crossley Oil Engine.

entrained and carried over, and an explosive mixture enters the cylinder. There are about as many types of oil as of gas engines. When the men become familiar with their working they give little trouble, but they need more care and cleaning than gas engines.

The old type of oil engine, as well as the gas engine burning "town gas", are now rather in disfavour, not because of defects, but because of developments of recent years in both the mechanical structure and the adaptation of cheaper fuel. Even where electric power is available many large firms are installing these engines as auxiliary in the event of the electric supply being cut off at an inconvenient period, as it is sometimes. The writer knows of a case where, on account of a strike of engineers, the bakers' power supply was cut off for nearly a fortnight. In this instance recourse was had to the use of a good tractor, which was taken to the bakery, fixed in position, and connected by a belt to the main shaft, the bakery machinery running in quite the usual way. The only defect of this temporary arrangement was the noise of the tractor motor and gear. The best types of oil engines are on much the same plan as ship motors. There is a magneto starter, while the power is supplied by petrol or in cases by paraffin. The usual expedient is to start the motor with petrol, using paraffin for the continuance of the power. There are many types of oil engines, just as there are of the gas-using sort, but they all depend on the oil being first vaporized, then ignited as an explosive mixture by coming in contact with a highly heated substance, as in an ignition tube, or by a spark from a magneto.

In country districts where power is generally wanted for chaff cutting, wood sawing, or other purposes, a small steam engine with crude oil as fuel is an economical source of power. This crude oil is very cheap. It is not explosive, nor can it be vaporized to form when mixed with air an explosive mixture for use in an internal-combustion engine, but by means of a special burner it can be so finely divided ("atomized") that it burns in a long flame giving intense heat; this heat, used in a furnace under a boiler, supplies steam to drive the engine, which can be easily coupled to either the bakery shafting or to that of the machinery for any other purpose required. In a bakery, even when the quantity of work is considerable, the amount of power needed is never great. It is seldom, in small establishments particularly, that all the machines are running at one time, and the most exacting—the dough mixer—very seldom requires more than 4-horse power for some sorts, and 2-horse power for rotary machines, while cake-mixing and batter machines can be readily driven with less than a half of that power. The writer knows of one case where a water motor of the turbine type, and driven from the public water supply, was sufficient to turn a one-sack mixer making fairly stiff doughs. Whatever kind of engine is employed, much power is saved as well as trouble prevented by systematic cleaning and oiling of all the working parts, and it is economy to provide good quality lubricant for engine, shafting, and machines.

CHAPTER VI

ELECTRIC MOTORS

In modern bakeries of small and moderate size the electrically-driven motor occupies a prominent position. In comparison with other methods of power supply, the following claims may be advanced in support of electrical machinery:—

Advantages of Electrical Power.

1. The space occupied by the motor (it being understood that only small machines are under consideration) is less than that occupied by other types of machines of equal power.
2. They are accompanied by less dirt and noise.
3. There is less power lost in friction in the machine, this gain being more pronounced the larger the machine.
4. They can be started without any previous preparation, and stopped with similar ease.
5. The speed is capable of easy regulation within the limits of the machine.

Supposing that it is decided to lay down such plant, the choice of the particular type of machine is in the majority of cases determined by the nature of the current supply in the locality. The current may be direct (or continuous), or it may be alternating; and, if the latter, it may be available in what is known as single-phase or polyphase form. It is then necessary to ascertain first what variety of supply is obtainable, and also at what pressure such supply is maintained. Having acquired this information, the purchase of a suitable machine is the next point for consideration. The cost of the actual motor does not represent the total outlay by any means; account must be taken of the necessary auxiliary appliances and also of the cost of wiring. As regards the machine alone, continuous-current motors and single-phase alternating-current motors do not differ much in cost; but for any given power polyphase motors are cheaper than either of the above. When an installation of electric power is contemplated, it is best to consult a reputable firm of electric engineers as to the best make and of the necessary power for the work to be done. The price given is usually that of the machine alone, the cost of starter, wiring, &c., not being included. This is dealt with later. From these prices a substantial discount could no doubt be obtained. They may be taken as an average quotation. Motors can be obtained at a lower figure; but a too rigid economy in prime outlay is not to be recommended.

Considerations Affecting Choice of Machine.

It will be discovered on inquiry that the price of a machine of any given power rises rapidly with the reduction of stated speed, the slow-speed machine being altogether more massive than the high-speed. A high-speed machine could be used, reducing the speed by some form of gearing at some loss of power in the process. The smallest of the above

machines could be easily accommodated in a space 3 ft. square, and the largest in a space 4 ft. 6 in. square. The price of the starter for the above would vary with the machine, depending on the power and on the current taken; it would run from about £2, 10*s.* to £4, 10*s.* over the pre-war range. A fairly good rule is to allow 15*s.* per horse-power. In the case of alternating-current motors, although, as stated, the cost of the machine itself might be less, yet where a starter is required such starter would cost considerably more than that for a continuous-current motor. Allowance must be made, too, for the cost of wiring. This item in the case of the smallest motors would amount (exclusive of the cost of the starter) to about £4, 10*s.* to £6. With the larger sizes, taking heavier currents, heavier cable would be necessary, and this would increase the cost, but not by any means to an extent proportional to the power of the motor. The cost of wiring bears its largest ratio to the cost of the machine with small sizes. But in any case the particular circumstances must be known (situation of machine, length of run of cable required, &c.) to estimate this portion of the cost.

Cost of Motors and Starters.

As a guide to the size of the plant required in any particular shop, the following table may be found useful. It gives the approximate power required for kneading machines of various capacities.

Size of Plant Needed.

Capacity.	Approximate Horse-power.	Capacity.	Approximate Horse-power.
½ sack	1–1½	2 sacks	4
1 ,,	1½–2	3 ,,	5–6
1½ ,,	3	4 ,,	6–7

These estimates of power needed for machines of certain capacity are subject to the qualification that dough-mixing machines of the same capacity may require much different power to drive them. Thus "rotary drums", on account of their only lifting the dough at one half of the turn, while even that work is assisted by the impact of the dough at the other side of the drum, require the least power of any. Those machines with one single lifting arm and a revolving mixing bowl are next most economical of power, the least exacting even of these being the machines with the work very near the power, that is, in which the arm is short and very near the driving shaft of the machine. In the cases in which there are two mixing arms, or in which the mixing appliance exposes a large surface and cuts the dough along two long lines at the same time, the power needed is high, especially when the mixing is nearly completed. It has become quite common to have the motor attached directly to the machine. This is economical of power, but necessitates several small motors, usually one on a shaft for all the smaller machines.

A small calculation will show how to estimate roughly the cost of

current supply. If the machine has its own voltmeter and ammeter, these readings can easily be taken. Then

$$\frac{\text{Volts} \times \text{amperes} \times \text{hours}}{1000} = \text{Board of Trade Units.}$$

Estimating from the known horse-power of the machine,

$$1 \text{ horse-power for } 1 \text{ hour} = {\cdot}746 \text{ Board of Trade Unit,}$$
$$\text{and therefore } {\cdot}746 \times \text{H.P.} \times \text{hours} = \text{Board of Trade Units.}$$

Knowing the cost per unit, the total cost can readily be estimated.

Types of Continuous-current Motors.

Continuous-current motors may be of various types, according to the method of winding. If the same current traverses the armature and magnet windings, the machine is known as a "series" motor (fig. 225); but if the main current traverses the armature, and a branch circuit is led off to the magnets, the machine is a "shunt" motor (fig. 226). A third type combining these two gives

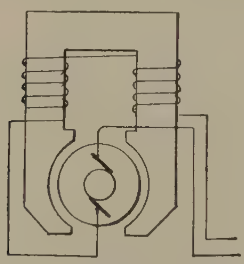


Fig. 225.—Diagram of Series Winding

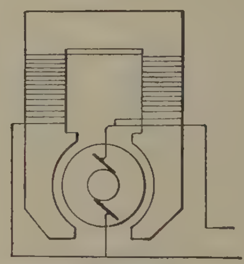
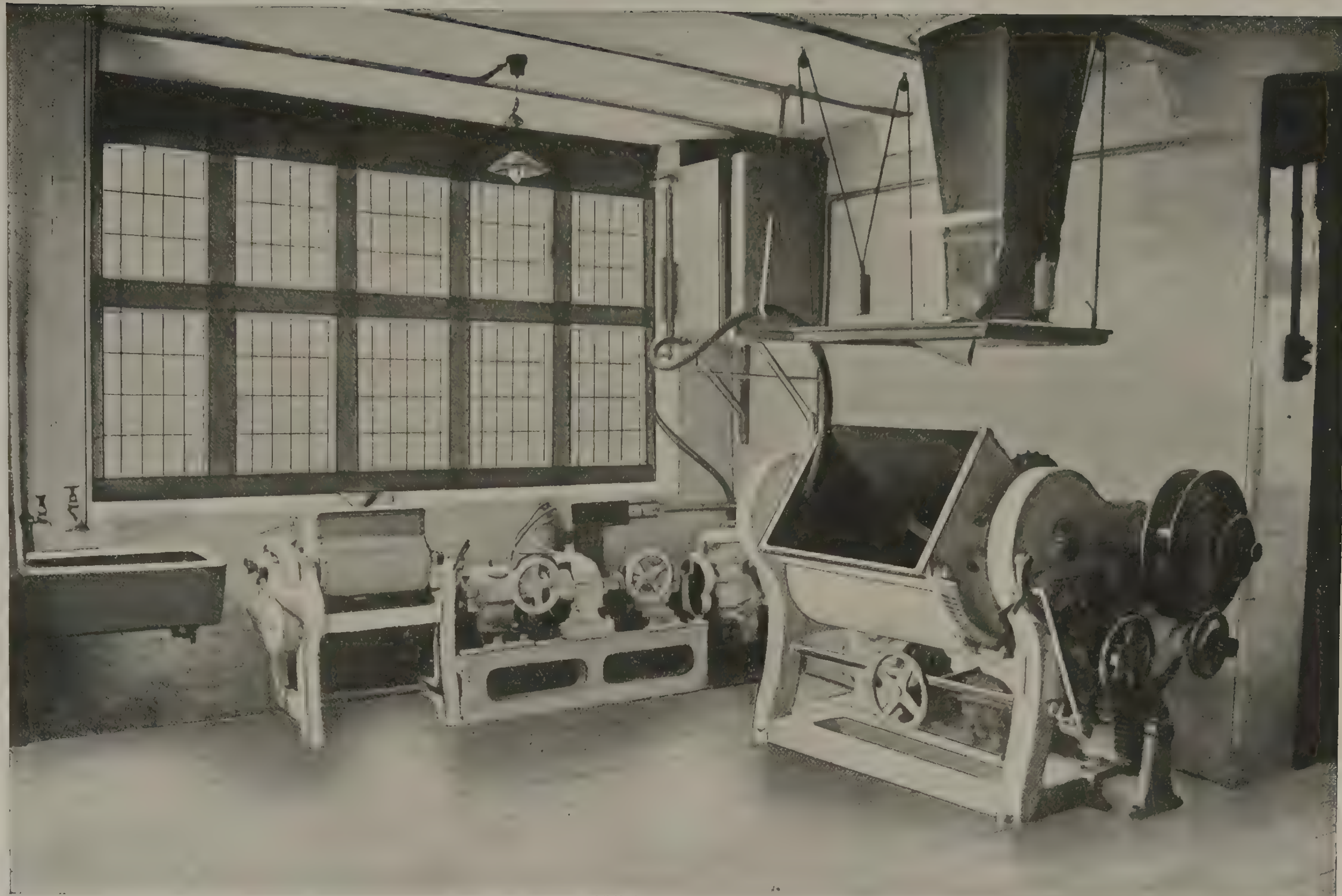


Fig. 226.—Diagram of Shunt Winding

the "compound motor". Each has its advantages and disadvantages, rendering it adaptable to some kinds of work and inadvisable for others. For instance, the shunt motor is best when a constant speed is required at different loads; and the series motor where great starting power is required, as in crane motors, &c. For bakery purposes the shunt motor would seem to be the better adapted on the whole.

Position of Motor.

The position to be occupied by the motor should then be chosen. This should be in a clean, dry place as free as possible from dust. This latter qualification may be difficult of attainment, but can be provided for by adopting a machine of the "enclosed" type, in which the running parts of the machine are, as the name implies, defended to a very great extent from the intrusion of small particles. The foundation of the machine should be quite level, and it may either be bolted down or mounted on slide rails. If, as is most probable, the power is to be transmitted by belting to a shaft, the adoption of slide rails allows for a slight alteration of the position, if necessary, to get the belt running to the best advantage.



CAKE AND BREAD MACHINES DRIVEN BY ELECTRIC MOTOR

Before starting the machine, see that the brushes are bearing properly on the commutator. Most machines are now fitted with carbon brushes, and several will probably be found in each holder. The brushes in the several holders should be arranged so that between them they bear on the whole width of the commutator. If this is not so, after running for some time those parts on which the brushes bear tend to become ploughed out, while the intervening surface remains intact; thus giving rise to grooves in the commutator, and leading to trouble later on. The brushes in the several holders should therefore not be in line with one another around the circumference of the commutator. Their bearing on the commutator surface can be rendered certain by hand-turning the machine with a piece of fine glass paper (not emery) beneath the brushes so that the glass paper may render them of the same slight curvature as the surface on which they bear. When satisfactory, remove all dust with brush and bellows. See that the oil wells are filled. The machine is then ready to start. The main switch of the machine is first closed, and the actual starting effected through some form of starting resistance.

Starting the Motor.

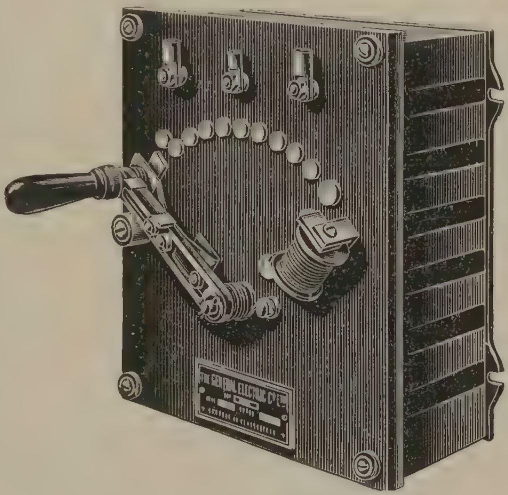


Fig. 227.—Motor Starter

For a continuous-current machine a typical starter is shown in fig. 227. It is to all intents and purposes a set of coils of heavy wire in series with the armature of the machine, which are at first in circuit and are then gradually cut out. The main switch being closed, the starting lever is moved on to the first stud. At this point a large current traverses the armature of the machine, and it commences to revolve. For the time being the machine may be regarded as a "generator", *i.e.* a machine to which motion is supplied resulting in the production of current. The current set up by this generator action tends to flow in the opposite direction to that sent into the machine from the mains, and so diminishes the current in the circuit. The voltage set up by the machine, in so far as it acts as a generator, opposes the voltage applied to the machine from elsewhere; and this opposing voltage is referred to as the "back electromotive force" or "back E.M.F." of the machine. Hence the current is diminished; the machine, in fact, could not stand for any length of time the current which passes through it at the instant of starting before the rise of the back E.M.F. This opposing force must be given a short time to develop as the machine speeds up, and hence the starting lever must be

moved very slowly stud by stud to its final position. The motion must at any rate be very slow at first, while as the machine runs up to speed the later studs may be passed at a somewhat quicker rate. On reaching the last stud the lever is, as a rule, held in position by a small electromagnet. If a failure of current occurs from any cause, the electromagnet is demagnetized, and the starting lever flies back to its original position by the action of a coiled spring. The motor being started, the speed can be adjusted as required by means of the regulating resistance, which would be found on the starting panel. This regulator consists of a series of coils by which the current passing through the field magnets can be increased or decreased as desired. With a shunt motor a decrease of the field current increases the speed, and vice versa.

Adjustment of Speed.

A motor, when newly put into work, will require some attention at first until it settles down. Small details must be looked after, and the machine may develop minor faults. Of the smaller faults a machine may exhibit, perhaps the most prominent is that of sparking at the brushes. This can, as a rule, be reduced to a very small amount, if not abolished entirely, the degree of success depending on the cause from which the sparking arises. A very frequent cause is a wrong adjustment of the brushes, either as regards their position on the circumference of the commutator or as regards the contact they make with the commutator bars. If from the first cause, the obvious remedy will be to alter slightly the position of the brush rocker. This can be done while the machine is running. It will be found that on moving the brushes round the commutator in one direction the sparking increases, and in the other direction it decreases. A position can be found, if this is the most conspicuous cause of sparking, where it can be reduced to a minimum. The angle through which the brushes are moved must not in any case be very large, as a shifting of the brushes through an angle equal to the pole pitch has the effect of reversing the direction of rotation of the machine. This angle is found by dividing 360 degrees by the number of pole pieces on the field magnets. It may happen that any noticeable amount of sparking only occurs at one set of brushes, and that on moving the brush rocker sparking at this set ceases and appears at another set. In this case it is not so much that the rocker position is wrong, as that the relative position of the brushes is incorrect, *i.e.* the various sets are not separated by the correct angle. This can easily be detected by a simple measurement, though in modern machines fitted with carbon brushes the construction of the machine is such as almost to preclude its possibility. The brushes in any one holder should, however, be adjusted so as to bear on the commutator in line with one another, error in this respect leading to sparking at the brush which is out of line when the remainder are running smoothly. If an alteration, either of the rocker, one set of brushes, or an individual brush, does not reduce the sparking, another cause must be sought. Roughness, either of the commutator or brush surface, will produce it, as such a cause means

Sparking at the Brushes.

constant bad contact of brushes and commutator. Brushes should be ground in when fitted to the machine as mentioned above, and examined periodically to see if they continue to bear properly. Carbon brushes should not be allowed to wear down at one edge and not bear on the whole surface. Roughness of the commutator may be caused by the ploughing action of the brushes causing grooves to appear after running a considerable time; or by the fact of the insulating material between the bars being harder than the bars themselves, and thus being left projecting when the copper is worn down. In either case sparking will occur, and will be accompanied with some amount of rattling of the brushes. The grooving action may be avoided by the means mentioned above. The only cure for projecting insulation, if it occurs, is to take a fine cut off the commutator. This is a matter, however, which will entail outside assistance and cannot be cured on the spot. Various other causes may give rise to sparking, but they are as a rule not of such a nature as to be capable of simple or immediate remedy.

Failure to Start.

Another trouble which may arise is a refusal of the motor to start when apparently all is in order. The absence of a necessary fuse may explain it, but this would be readily detected on examination. The source of failure may be a breakdown at the local generating station, and it may be necessary for a time to cut out a certain district (a proceeding in which supply companies sometimes indulge). Against this one is powerless, and can only await a resumption of supply. A breakdown in the plant itself is frequently difficult to locate, and not always capable of rapid remedy even when located. A wrong connection may account for it; this would be detected at the first attempted run, and would not occur afterwards unless the machine had been tampered with. The various terminals of the machine being determined, care should be taken that they are properly connected to the particular type of starter in use, and also that the plant is properly connected to the positive and negative terminals of the supply mains. The terminals of a starter are usually marked L, F, A (line, field, and armature, respectively); the connections should then be made to the starter in accordance with the marks. Where not marked, the "field" terminal, at any rate, may be identified by its smaller size or from its being fitted with a smaller "thimble" for the cable. If the machine has previously run satisfactorily, this cause is practically ruled out. A break may have occurred in one of the coils of the starter. This can be determined by carefully moving the lever over the first few studs, when, if one of these is broken, the motor will start after passing the broken coil. Great care should be taken in making this trial, and it should never be continued beyond the first two or three studs, although it would detect the fault beyond this. If the broken coil is one of the later ones and the process is continued, the motor on starting would take a very large current, and this sudden rush might cause a burn-out of the armature. If a break in one of the later coils is suspected the starter might be examined, and if such a break is

found it may be short-circuited by a short piece of stout wire similar to that of the other coils. A wrong connection of the field coils, so that they oppose each other in action, may occur. This can be detected by testing the poles of the machine with a compass needle, and, if in error, altering the connections to suit the particular case. A break in the internal arrangement of the machine would, of course, entail a refusal to start, and this is a matter for special treatment and cannot be remedied on the spot.

Excessive Heating of Parts.

No part of the machine should at any time during several hours' run become more than just hand-warm. It is as well to try various parts occasionally to see if this is so. If heating occurs, it is an advantage to know which part heats first, as the other parts of the machine are liable to get hot by mere conduction. Heating of coils almost always means excessive current through them, and this should be at once decreased. For instance, in a shunt motor whose field coils heat, the shunt current is too great and can be reduced by the regulator, entailing an alteration of speed. A coil remaining perfectly cold while the others are warm is short-circuited, and this fault may be at the same time the cause of the heating of the remaining coils.

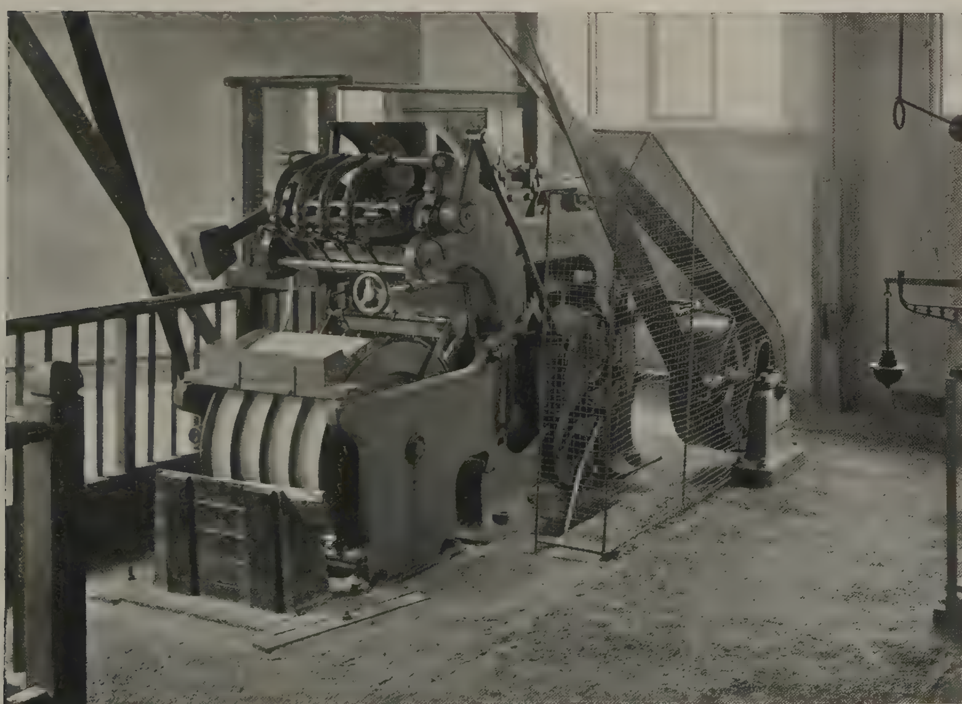
Trouble will at times arise even with the best-managed plant, but with care no serious difficulty should arise within a reasonable life of the machine. Wherever a current supply is available, electric motors represent for bakery purposes without doubt the most desirable form of power supply on hygienic as well as other grounds, and the installation of such plant cannot fail to prove its value within a comparatively short period.

The measurements used in connection with electrical power are rather difficult for the non-expert to understand, but it is as well to know enough to prevent confusion. The "watt" is the unit of power, and is equivalent to 1 amp. multiplied by 1 volt. A kilowatt is equivalent to 1000 watts. The mechanical horse-power is equal to 750 watts.

An ampere is the unit of electric current, that is, the unit of the rate of flow or stream. The volt is the unit of electric pressure, and is analogous to steam pressure.

The ohm is the unit of electrical resistance. What is called Ohm's law defines electromotive force; it connects the three units, volt, ampere, and ohm. The current in any circuit is directly proportional to the electromotive force, and inversely proportional to the resistance. The units are so chosen that when there is 1 ohm resistance in circuit, an electromotive force of 1 volt produces a current of 1 amp.

PROVER DELIVERING INTO CALLOW-BAKER DOUGH-MOULDING MACHINE



DIVIDER AND HANDER-UP

AUTOMATIC BREAD-MAKING PLANT

CHAPTER VII

BAKERY FITTINGS AND LABOUR-SAVING APPLIANCES

Long hours of work in a bakery are sometimes due to want of knowledge or want of ability on the part of the workmen; sometimes they are due to the task being too great for the number of men employed; but want of oven capacity frequently protracts the hours of labour, and a less apparent but important contributory cause is the unsuitability or insufficiency of appliances. In previous chapters the description of the use of machines and patent ovens has been given at some length, but it is surprising how ineffective even expensive machinery may be if accessory appliances are not provided to expedite the work.

Causes of Long Working Hours.

In an up-to-date modern bakery everything is done to effect economy, and appliances are provided that make each operation as precise and easy to record as possible, so that one man may be instructed to attend to it as well as another. Beginning with the oven, it is a common experience to find that, regarding the stokehole of bakers' ovens, there is the greatest disorder in the way in which fuel is stacked, and the greatest laxity in the manner in which quantities are recorded. A suitable method of recording the quantity of fuel used and the value of heat received from it has been already described; but as it is not always convenient to weigh fuel, reliable data can be easily obtained by its careful measurement. For this purpose an iron bin with an open top and a slide door at the bottom should be provided. It is easy by one weighing to ascertain the exact capacity of the bin when filled to various heights and when quite full. By this means the quantity of coke used each day can be properly ascertained, and an efficient check kept on its use, at the same time that the stokehole is maintained in an orderly condition.

Waste in the Stokehole.

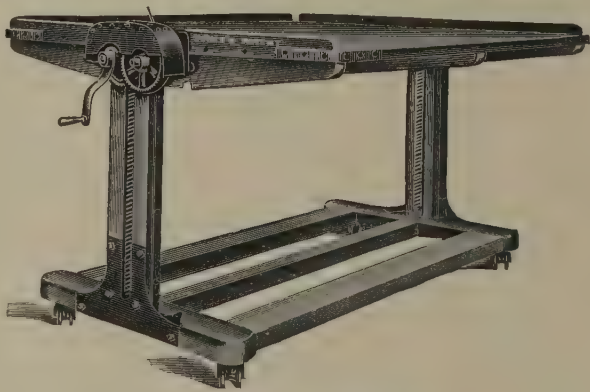
At the front of the oven a little thought can devise inexpensive appliances that facilitate the work with the minimum of labour. If the ovens are of the peel sort the peels should be kept overhead, the peel heads in a box convenient to the oven mouth, the handles in a rack the proper distance away. When short and long peels are used two racks or supports for the ends of the shafts may be provided, the one nearer the oven being a little higher than the other. The peel heads are best kept on their edges, as this necessitates only a very narrow box with a division for each peel head, and it keeps the peels cleaner. This arrangement expedites the work considerably, and is much better than stacking a lot of peels in a corner, where they are always in danger of being knocked down. If the ovens are of the drawplate type, a special brush should always be kept on a convenient nail or shelf near the front of the oven to brush off the plate, and the long flat boards for clearing the plate should have holes in them and be hung conveniently at the side of the oven. When bread is to be set or

Racks for Peels.

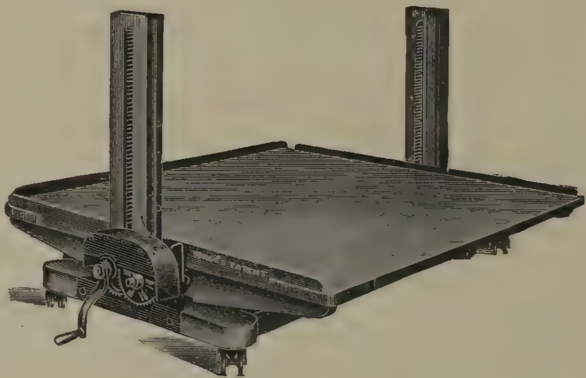
Accessories of Drawplate.

drawn in a peel oven, it is convenient to have a small table with a zinc-lined top on castors so that it can be easily turned into position at the side of the oven; a light frame rest should also be provided for the end of the peel. When the ovens are of decker type, it is necessary to have a convenient table at the level of the top oven as well as of the bottom.

Rise-and-fall Tables. To meet this double requirement a rise-and-fall table (fig. 228) has been designed, to be used either with peel ovens or as a drawing table for decker draw-plates. An ordinary strong table with zinc-lined top, and with as many shelves as possible underneath to take the hot tins as they come from the oven, serves the purpose of a draw-table; but as space is usually an important consideration in a bakery, appliances that serve more than one purpose are extremely handy, and a good deal of ingenuity has been exercised in recent years in saving space in this way. Fig. 229 shows an appliance of this kind.



Raised. Maximum height, 3 ft. 9 in.



Lowered. Minimum height, 1 ft. 1½ in.

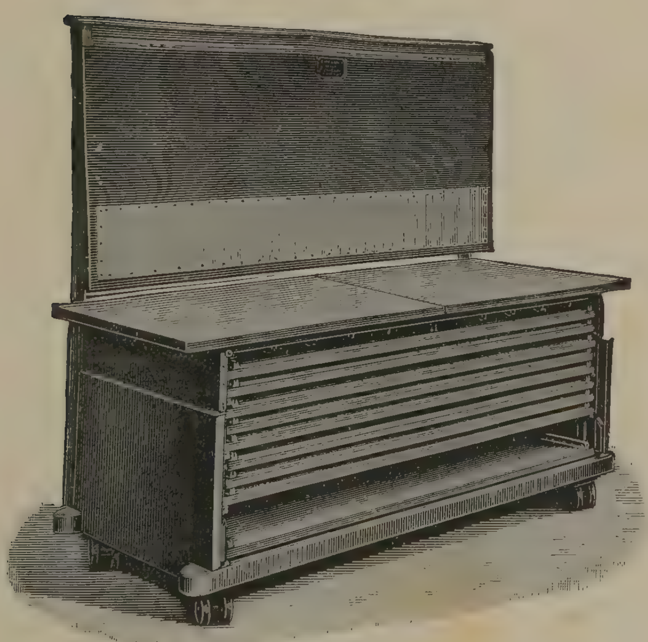
Fig. 228.[1]—Rise-and-fall Table

Combination Proving Rack. It is a combined proving rack (*a*) for tin bread which can be converted with ease into a drawing table (*b*). The sides are divided and hinged so as to fall over and form a table top, and the top is hinged so as to fall down and form a back. When let down in position to form a drawing table, the top and part of the back are covered with galvanized iron, which is convenient for greasing tins or packing goods. When the appliance is in use as a prover, a cloth cover fitted on a patent metal roller with spring inside can be let down in front and will remain in any desired position, so that as each board of tins is filled it can be covered to prevent draught.

As drawplate ovens are now very much in use, there are many devices adapted for their speedy loading and discharging, as it is of the utmost

[1] The illustrations, figs. 228–239, 241–245, are the copyright of Messrs. Tonge, Pendleton.

As Proving Rack



As Drawing Table

Fig. 229.—Combined Proving Rack and Drawing Table

importance that the plate should not be allowed to stand out a minute longer than necessary. A comparatively simple but efficient loading arrangement consists of long boxes the width of the plate, but with one side hinged to drop down to allow the bread to be discharged on to the plate. As these boards are filled, and as their sides are deep enough to allow the loaves to prove without touching the bottom of the board above, they are piled one on top of another, each board forming a cover for the one underneath. When ready for setting,

Drawplate Loading Setters.

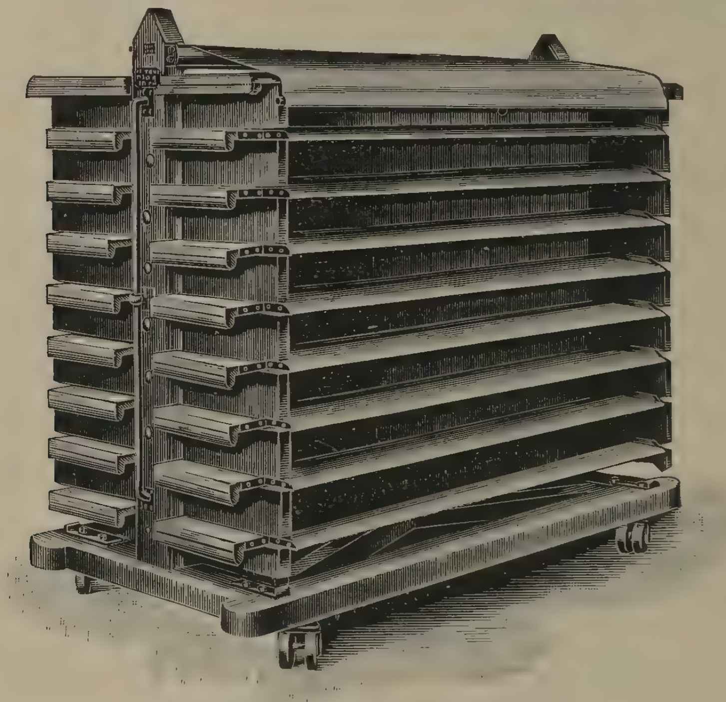


Fig. 230.—Proving Rack and Setter, Combined

the side, which is kept in position by a very simple drop clip at both ends, is released, and two men slide the loaves quickly on to the plate.

A more elaborate setting arrangement is shown in fig. 230. This is also a Tonge patent. The advantages claimed are that as the trays are quite flat and have no high sides they are much lighter to handle, whilst all the advantages of having sides and ends are obtained by the construction of the rack. The trays have not to be drawn wholly out when filling, as they hold themselves in position when half drawn out, so that the men can readily get at the back row of tins. Another form of "setter" for drawplate ovens is shown in fig. 231, and by an ingenious arrangement the boards of the setter can be used in succession as draw-tables for the bread after it is baked, thus obviating the necessity of handling the bread at all. The usual fitting for discharging drawplate

Sideless Setters.

ovens is, however, an ordinary stout table (fig. 232) with galvanized-iron top and with a small ledge round three sides.

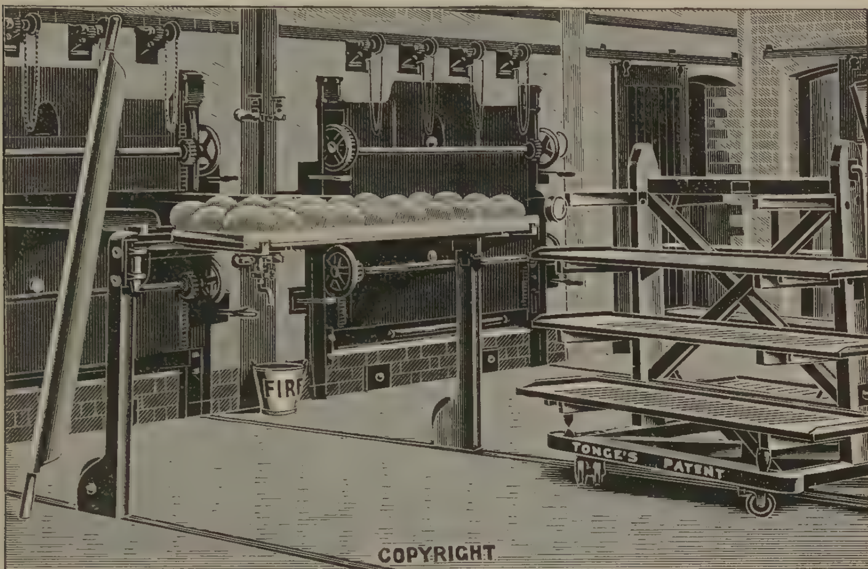


Fig. 231.—Setter for Drawplate Ovens

The tables in a bakery should all have good thick tops, preferably of some hard wood that will not splinter. What is known in some places as

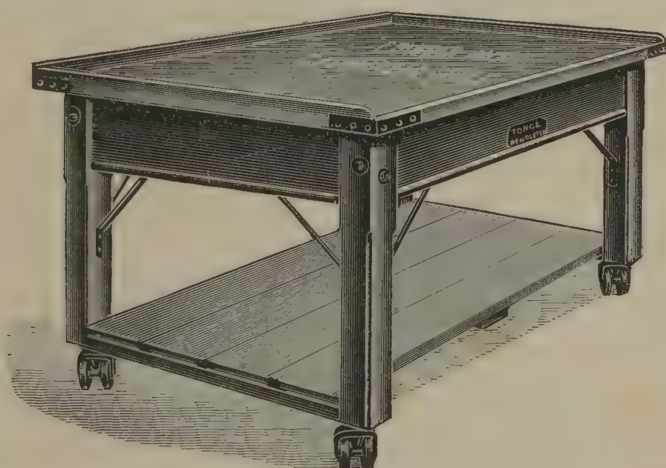


Fig. 232.—Discharging Table for Drawplate Ovens

plane-tree, and in others as sycamore, is very suitable for this purpose. Some bakers object to such hard wood, because its surface becomes so smooth that it does not grip or hold the dough when moulding. This fault is only apparent to bakers who have been in the

Hardwood Table Tops.

habit of working on softwood tables, and who have learned to expect the table to do part of the work; but to anyone familiar with a hardwood table top the comfort, freedom from splinters, and the good wearing qualities of the table are more than sufficient to compensate for any seeming disadvantages attaching to them, and to these men there are no difficulties of moulding or any other bakery operations. It is common now to find bakery tables as well as other fittings mounted on strong castors to facilitate cleaning; but unless the table is a very large and heavy one it is really better to have only one side so mounted, as this ensures its keeping in position and gives steadiness.

When a considerable quantity of paste goods has to be made it is neces-

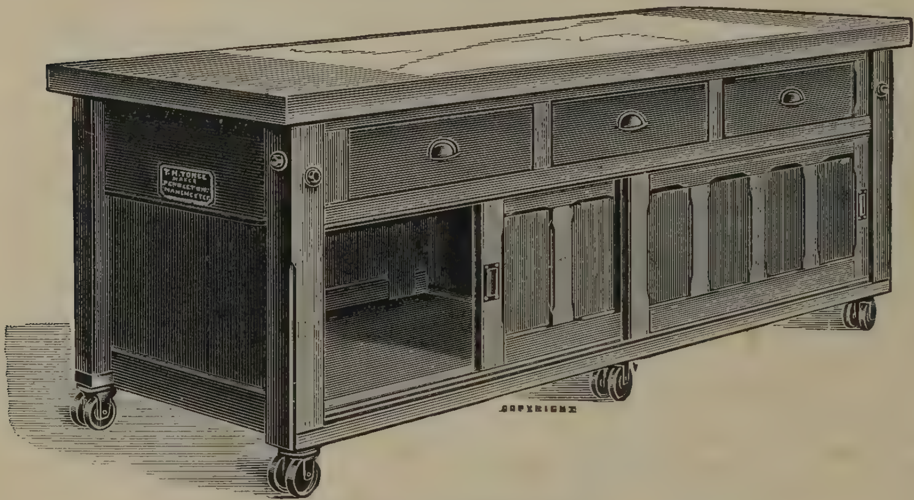


Fig. 233.—A Confectioner's Table

sary that for summer work a table with a marble slab should form one of

Confectioners' Tables.

the fittings. Fig. 233 shows such a fitting, with drawers and cupboards under, so that the many small utensils used by confectioners can be neatly stored away when not in use. This arrangement is useful when bread bakers and confectioners have to use the same bakery and the same tables; but the writer prefers the plan of keeping the small utensils as much as possible out in the open, each appliance in a suitable place of its own, and few doors to cover up utensils placed away in a dirty state or kept in an untidy condition (fig. 234).

One of the essential fittings in all bakeries that seems to persist in type is the dough trough. The usual form in English and Irish bakeries

Dough Troughs.

where hand work still prevails is a long deep trough with sloping sides, the front at a wider angle with the bottom than the back. The purpose of the slope on the front seems to be to allow room for the knees of the worker, so that he may stand in a position that gives him most power to perform the hard work of mixing and lifting. One of the objectionable things about troughs of this sort, especially if the

bottom is very narrow, is that their shape necessitates a great thickness of dough to cut through and lift while dough-making, and entails a greater strain on the worker than there is need for. The tendency now is to build the trough with a much wider bottom than formerly, and of course with sides sloping only very slightly. An old Scottish type of trough was usually called a dough table. It is built on higher legs than the sloping-side troughs just referred to, and is the same width at the bottom as at the top, with the sides quite perpendicular and not more than 16 in. deep. The higher legs allow the baker to stand in the most advantageous position for working, and the broad bottom entails only a comparatively thin sheet of dough to lift and turn, so that mixing in this form of trough is very much easier than in one with a narrow bottom. The writer has had a long

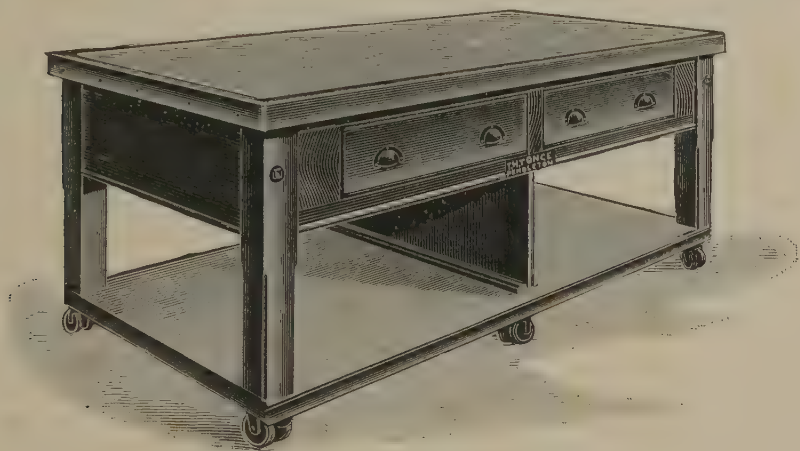


Fig. 234.—Confectioner's Table with Marble Top

practical experience with both types, and can vouch for the advantage from the workman's point of view of the wide-bottomed trough. On the Continent generally, at least in Austria, Germany, Belgium, and Holland, the prevailing type of dough trough is of galvanized iron, and is round at the bottom. It is possible to have a metal trough of this kind jacketed either for water or steam, so that the temperature of the dough can be raised or lowered should occasion require. In small bakeries, where the oven room is limited and the working staff small, it is a measure of safety to be able to accelerate or retard the speed of working of a dough by means of a jacketed trough in this way. On account of the increased expense this special kind of trough has not, however, been generally adopted.

Iron Troughs.

Jacketed Troughs.

The rounded form of trough makes dough-making very easy even as compared with the Scotch dough-table type, especially if the doughs are not very large. The trough is shallow and long, and the circular movement of the hands is quite in the natural direction. In Britain there is a prejudice against metal troughs, on account of their

Rounded Troughs.

conductive properties and the cooling effect on the dough. It may be pointed out that these iron troughs, although they may feel colder than wooden ones, are only at the same temperature as the atmosphere of the bakery, and only cool dough rapidly if the temperature of the dough is very much higher than that of the bakery; while if the bakery is actually warmer than the dough, then the latter will gain heat quicker than in a wood trough, and will in consequence work quicker. One advantage accruing from the shape of the iron trough is that its shape makes it easier to clean and keep clean than a wood trough. To get over the difficulty just referred to as arising from the conductivity of metal, a trough of the same shape as the metal ones, but with the bottom made of bent wood, or built circular, is now made, and may be used either as a mixing-trough or as a truck.

Fig. 235.—Blakeway's Patent Trough

In Holland a composition consisting of fine sawdust and some sort of cement is used for making seamless troughs and table tops. This material can be cast or moulded into any shape, and presents when hardened a smooth surface that is very easily kept clean; all corners of the inside of the troughs and the junction of the bottom and sides are rounded to prevent the lodgment of dough and to facilitate cleaning. This material is very hard and durable, and stands washing or scraping. As a conductor of heat it is very little better than wood, so that even in a cold bakery it does not chill the dough. Troughs made of glazed porcelain are in

use in some considerable bakeries. These are easily kept clean, and as they are of thick material and glazed they do not have anything like the cooling effect of an iron trough on the dough.

Glazed Porcelain Troughs.

A recent addition to types of troughs is that made by Tonge called Blakeway's patent. This is a metal trough specially enamelled inside and cased outside with wood. Fig. 235 shows a dough truck of this sort, but if wanted as a mixing trough it is built on legs in the ordinary way. In a trough of this kind the corners are all rounded, and as the inside is perfectly smooth the dough does not stick; the outside lining of wood prevents loss of heat. The original cost is considerably greater than that of a wood trough; but it is claimed, and not without reason, that the saving in scraps, the ease in cleaning, and the prevention

Blakeway's Patent Trough.

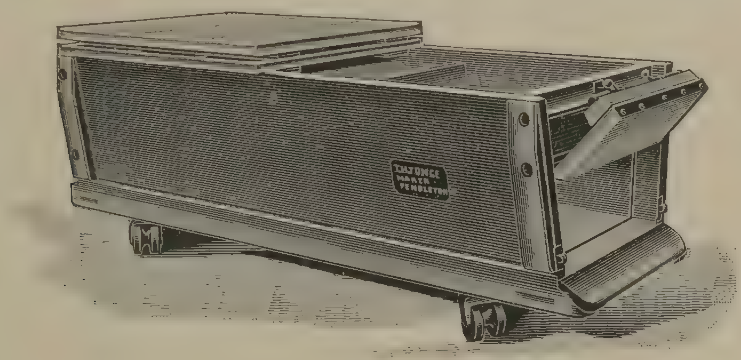


Fig. 236.—Machine Dough Troughs

of such diseases as "rope" in bread are much more than compensation for this extra cost.

As an accessory to the ordinary mixing trough in the bakery, a small trough which can be suspended within the large one has been patented by the United Yeast Company. The purpose is to provide one or more small troughs for mixing and proving the numerous little doughs required in the modern bakery, where so many kinds of bread and rolls are now made, under identical conditions with the large doughs. For brown and fancy breads, of which only small lots are needed, these little troughs are a great convenience.

Use of Small Inset Troughs.

In machine bakeries the mixing trough has given place to the dough truck on low castors. These, like troughs, are usually made with sloping sides, although vertical-side trucks are easier emptied from the top. On account, however, of the needs of different types of machines, and of the varying position of these machines in the factory, dough trucks have to be modified in many ways to suit individual needs (fig. 236). The dough may be made at the top floor of a factory, and then requires to be dropped through a shoot to one or two floors underneath; in such a case it is a convenience to have an opening at the end or in the bottom of the truck through which the large

Dough Trucks.

pieces of dough as cut off can be pushed into the shoot instead of being lifted out at the top. By a simple device like this the workman's labour is much economized. Mention has been made of a shoot by which dough is conveyed from one floor to another; the most serviceable fitting of this kind with which the writer is acquainted is a long semi-circular planished iron trough or gutter, along which the dough slides very easily. There are no corners in it, and as the ends of the iron plates overlap in the direction in which the dough moves there is no obstruction. A shoot of this kind is more serviceable than a closed one of wood.

Dough Shoots or Conveyors.

A large quantity of work can be done only when the men are provided

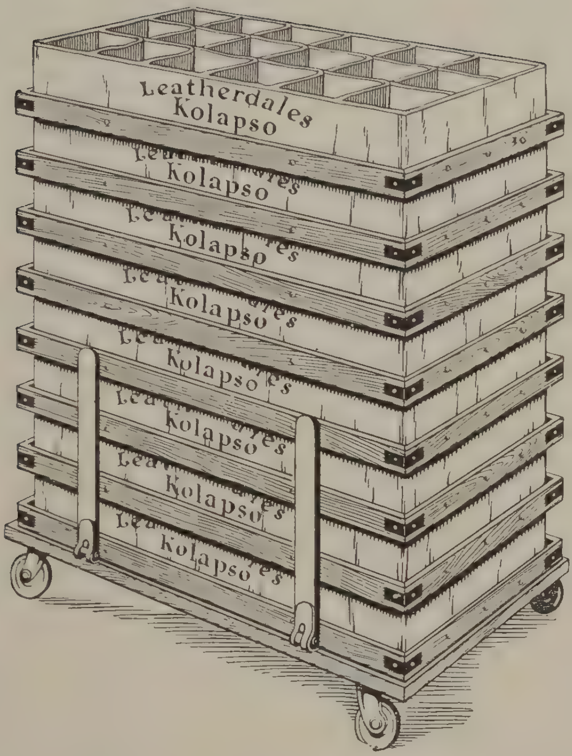
Fig. 237.—Case of Small Bread Drawers

Fig. 238.—Patent Double Prover

with suitable appliances, and for goods made with yeast and requiring proof the facilities for proving cannot be too good. In Scotland and Ireland, where large quantities of rolls and baps are made, these require to be proved in a warm dry place. The usual plan is to have one or more cases of shallow drawers underneath the table or in some warm situation, but generally fixtures; to obtain the necessary heat the drawers have to be heated singly, generally in the oven, which does not improve their chance of long use. Fig. 237 shows a case of small bread drawers on castors which when being filled, and while the rolls are proving, can be moved to any convenient warm place in the bakery. For buns and other goods needing a moist heat a prover fitted with a gas ring and a pan of water is provided (fig. 238), or where a steam boiler is available a pipe conveying naked steam from the boiler to

Cases for Small Bread.

Bun Provers.



COLLAPSIBLE PROVING PARTITIONS TO REPLACE BOXES

THE PARTITIONS AS STORED

SPACE-SAVING DEVICE

the prover is fitted. It is an objection to some provers fitted with a gas ring that this ring is placed in a sort of well, to which access can only be obtained by removing an iron-lined protecting board and steam spreader which covers the well; then this spreader must also be removed before the water pan can be removed or even filled with water. There is both difficulty and danger in some of the provers now provided for bakers—difficulties such as those just mentioned, and danger that the gas may be left alight after the work is done, for it is so boxed in that it cannot be seen unless by bending till the head nearly reaches the ground. It would be much better if the well part of the prover were fitted with a separate door, or the whole front of this part hinged like a flap, so that the whole steaming apparatus could be properly seen; and the water pan would be much better made square and run on slides quite independent of the gas burner underneath. If the prover is intended for naked steam from a boiler, the bottom part should be lead-lined, with a draw-off cock to remove the water from the condensed steam.

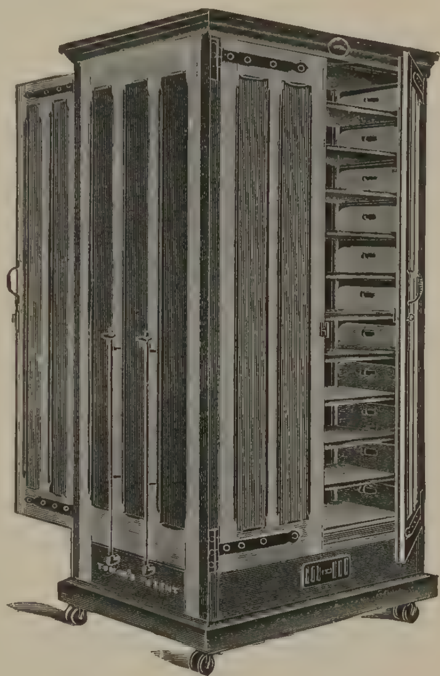


Fig. 239.—Vienna and Long Loaf Prover

Prover for Vienna Batons.

For proving Vienna batons or other type of long loaves, fig. 239 shows a convenient fitting. The boards in this have deep sides, but neither front nor back; the loaves are proved in cloths across the board. When they are in the case they can be kept quite free from skinning. At the oven the boards can be piled on top of each other ready for setting. As these long loaves are difficult to handle when proved, especially if the dough is soft, a number of thin slips of wood shaped something like a bat should be provided (fig. 240), on which the loaves are turned from the cloths and cut before being placed on the peel. As this piece of wood is a little longer than the loaves and very thin, the softest piece of dough can be deftly turned on to it quite straight and shapely and without any finger marks even if it is well proved.

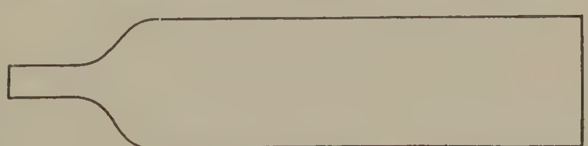


Fig. 240

Stick for Handling Loaves.

Tin bread requires long proof, generally before baking, and nothing

is so important to secure even texture and a nice bright crust as keeping the loaves while proving at an equable temperature and free from draughts. The usual plan to secure these ends is to prove the loaves in a closed cupboard, or in a prover with cloths on rollers as the protection. An ingenious device (Handley's patent) consists in an arrangement of bread setters for a drawplate oven set on top of each other a sufficient distance apart to allow the tin loaves to prove properly; then a cover is provided, slung on strong cords from

Handley's Patent Provers.

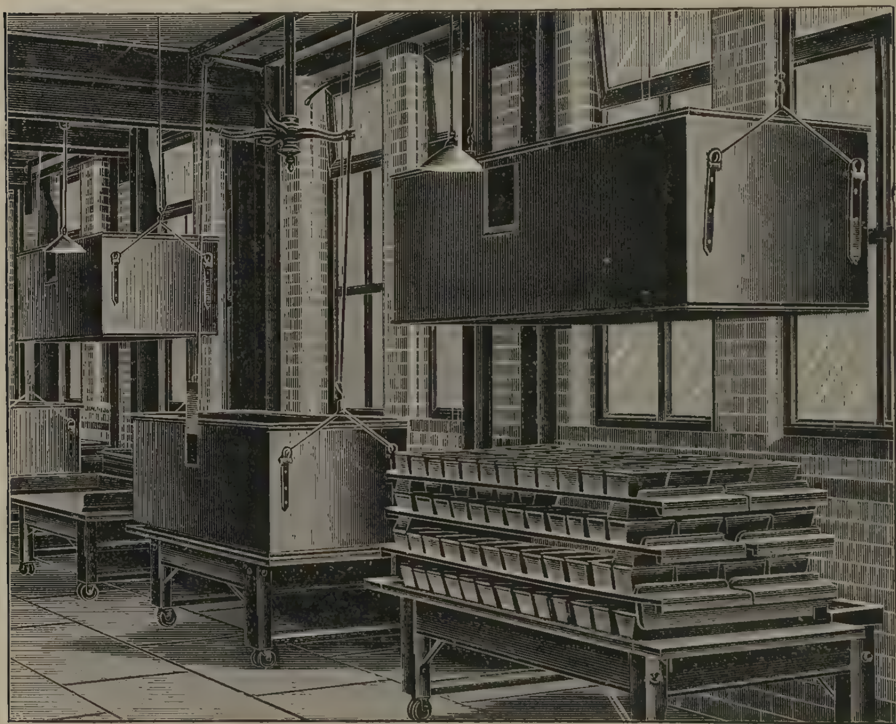


Fig. 241.—Handley's Patent for Tin Bread

pulleys (fig. 241) at the ceiling; the raising or lowering of this cover is facilitated by a balance weight.

Boxes for Crumby Loaves.

Where crumby bread forms a considerable portion of the work, it is necessary to prove the loaves in boxes. These are best on castors, so that when setting, the whole case can be pulled up close to the side of the oven. The boards may be either piled up on top of each other on a rack (fig. 242) or placed in a proper case (fig. 243). The latter is the much better arrangement. If the former plan is adopted, it is necessary to relift all the boards after they are filled and place them in the reverse order to that they are first in; otherwise the loaves moulded last will be set first in the oven, and those moulded first are likely to be overproved.

In bakeries where bread and confectionery are both made, it is much better that the confectioners should either have a special apartment to themselves or should at least have a part of the bakery with tables for their special work. Fig. 244 shows a combination table with drawers, racks, and other conveniences, which expedites and makes the work easy by giving the maximum of convenience in the smallest space. By means of the draw-boards with holes for beating pans, the whole table is available for other work, and the racks underneath facilitate the work by reducing the amount of running about needed between the table and a rack for tins placed elsewhere. A fitting specially adapted for the work of the confectioner increases very much the capacity of the workman, besides making his work pleasanter for himself.

Confectioners' Table Fittings.

Fig. 242.—Nest of Boards

A sugar or flour sieve is almost too common and simple an appliance to warrant mention here, but we must refer to an ingenious device in this line that is worth the attention of every baker, confectioner, and caterer. This is Ward's patent sieve (fig. 245). This consists of a whole set of sieves, with a mesh ranging from that suitable for straining soups and gravies to one large enough for any purpose for which a sieve is needed. The sieves proper are simply round, with strongly wired rim; with these a set of three strong, block-tin frames are provided. The sieves are neatly numbered with a little brass tablet according to the mesh. Each sieve fits accurately into any of the frames. If it is desired to remove one sieve and replace it with

Ward's Patent Sieves.

another, the operation occupies only a few seconds, and the frames and wiring of the sieves are so substantial that they fit together quite firmly. The writer has had some experience of these sieves, and can vouch for their efficiency. Everyone knows how awkward a great many sieves about a bakery may become when space is limited, and how soon they

Fig. 243.—Proving Case for Crumby Bread

break away at the part where they are joined to the wood rim, especially if they have been used for currant-cleaning or for straining liquids of any kind, and are put away damp or dirty. These sieves occupy no more space than so many round sheets of cardboard, and if placed in a neat rack they keep quite level and round; being quite flat, they are always easy to wash and dry. The three frames provided with the set of sieves are made to fit accurately into each other, so that if each is fitted with a sieve of different mesh it is possible to grade anything

being sifted, say almonds or sugar, into three sizes at one operation. The sieves may be used for any sifting purpose whatever, including fruit-cleaning.

Another simple bakery appliance that receives very little attention is

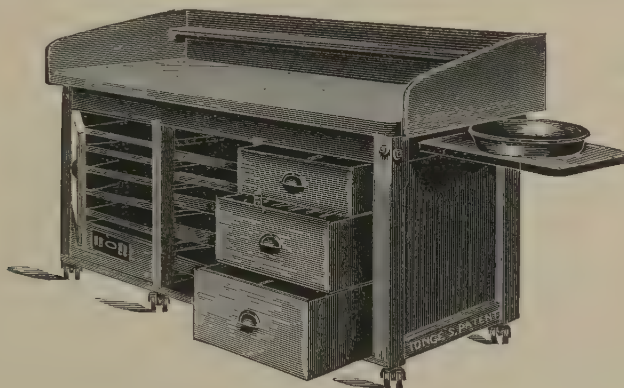


Fig. 244.—Confectioner's Combination Table

Bakehouse Scales.

the scales. Any old weighing-machine is considered good enough for bakehouse use, with the result that small quantities of anything like chemicals cannot be weighed with any degree of accuracy, and goods are irregular in consequence. For accuracy, beam scales are very much better than the machine sort generally used, and amongst beam scales hanging ones have least in the nature of com-

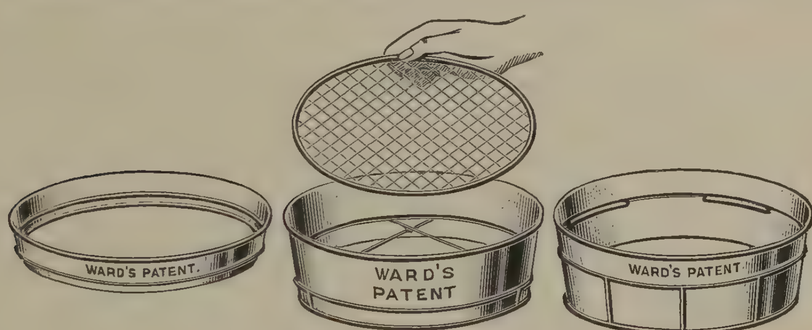


Fig. 245.—Wards' Patent Sieve

plications to cause them to go wrong. It is a good plan to suspend the hanging scales from a hook in the ceiling, and to have another cord with a balance weight attached to that carrying the scales, so that when not in use they can be pushed up and left suspended in any desired position. Scales hung in this way save table space, and as they get the minimum of rough usage, they keep fairly accurate.

After the bread and confectionery are baked, there can be a great deal of economy shown in their proper arrangement and disposal. It

may be accepted as a safe principle that nothing should be handled more frequently than absolutely necessary, and if by taking thought the bread or other goods can be packed as they come from the oven, in the number and form in which they are afterwards to be delivered to vanmen or to customers, much time can be saved in the course of the week, and the goods are all the brighter for not having been much handled. Thus it is convenient that the actual boards to be used in the vans should be those in which the bread is packed from the oven, and the number of loaves on each board should be the same. Much economy arises from a careful standardizing of the size of all fittings, whether sheets, boards, or what not, so that counting quantities becomes an affair of multiplication, and not, as too often happens, a weary plodding at addition, with its great possibilities of error. Some very crude appliances in the way of bread racks are provided in some bakeries, with compartments of varying width and boards of all sizes, the variations producing much extra work and causing confusion. A few pounds judiciously spent in proper bread-room racks and standardized trays or boards is money very well spent. Various styles of racks for both bread and confectionery can be obtained at low cost in convenient sizes, either to stand in the bread room for store racks or to be used for making up the orders of individual vanmen as required. All these appliances are best fitted with strong castors, so that they may be easily shifted for cleaning, or so that they may be packed right from the oven and unloaded straight into the delivery vans.

Standardizing Appliances.

Bread and Pastry Racks.

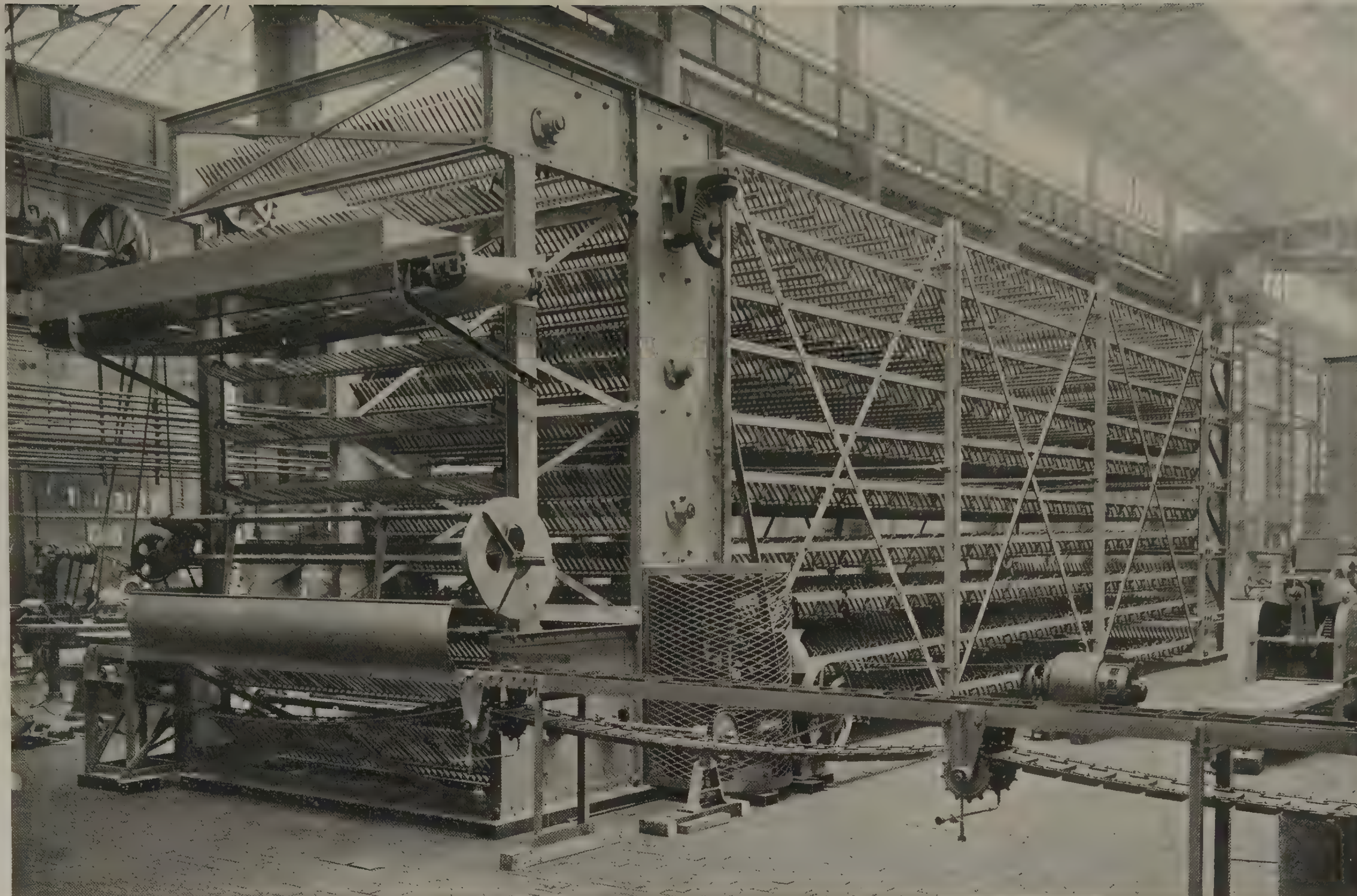
CHAPTER VIII

THE TESTING ROOM AND ITS EQUIPMENT

Every baker who aspires to attain a complete mastery of his craft should possess sufficient skill in testing to be able, whenever occasion requires, to submit his materials to an examination for commercial value and purity. It is by no means necessary that he should be a thoroughly trained chemist. Such chemical knowledge as he will require for conducting his special technical tests he can acquire during a course at any of the bakery schools throughout the country. This should be supplemented by following a recognized course in pure chemistry at a technical institute, special attention being paid to practical work.

Testing Samples.

The universal adoption of the experimental method in all matters appertaining to science and technology has led to the establishment of a vast number of critical methods for judging every kind of article, so that without exaggeration it might be claimed that we live in a "testing" age. Whereas formerly business men were content to buy their materials upon the guarantee of the vendor,



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AUTOMATIC BREAD COOLER

supplemented at most by a cursory examination of a specimen by sight, smell, &c., it is now quite everyday work in some large businesses to submit samples of each proposed purchase to searching physical and chemical tests before even considering the matter of price. This must not be taken as utterly condemnatory of the older methods, for it is perfectly certain that long experience frequently produced buyers of remarkable sagacity and unerring judgment. Rather, it must be ascribed to the recognition that the tracing of all defects to ultimate causes has revealed so many subtle properties which are intimately connected with the value and quality of an article, as to make it unsafe to trust entirely to the simpler methods which took account of external characters only, and could not possibly detect the hidden entities upon which those characters depended.

Assistance of Chemical Expert.

It has already been said that the ordinary tests of the bakery do not require the labours of a highly trained chemist. On the other hand, it is false economy to attempt always to do without such assistance; therefore, when questions arise requiring specialized skill for their investigation, such work should be entrusted to one who has made a study of experimental work and who may be regarded as an expert. This course is particularly to be recommended in all such dealings as are likely to become matters of dispute. It may be urged that the best safeguard against buying low-quality or adulterated goods is to deal only with merchants of high repute whose integrity is beyond question. Without doubt this is perfectly true, for so cunningly is adulteration practised in these days that it frequently requires the application of the most refined and delicate processes of analytical chemistry in order to detect the fraud. Nevertheless, no skilled tradesman cares to be continually in a state of helpless dependence upon others, and he will not be content until he is in a position to check at will the guarantees of his merchants.

The ability to test a flour intelligently necessarily involves a fairly comprehensive knowledge of all its properties, and the man who can do this will frequently be able to take advantage of market opportunities which others less informed do not realize, or in practice he can speedily devise ways and means for overcoming defects whenever they arise without sacrificing large amounts of valuable raw material or displeasing customers by selling faulty goods.

The Place of the Laboratory.

It will seldom be found possible in ordinary bakery businesses to erect a special building for the laboratory. In rare instances, when an entirely new building of the factory type is being planned, it may be found possible to set aside a purposely designed room for this work; but in the great majority of cases the baker will have to find a small room or part of a room, generally in a private house, and this will have to be adapted as circumstances will permit to serve the purpose in view. It is inadvisable to attempt to carry on testing work either in the bakery or the flour store, as some may be tempted to do. Apart altogether from the difficulty of maintaining privacy in such situations, there are other

very strong reasons why chemical work should be kept rigidly apart from the ordinary manufacturing processes. Flour is extremely prone to absorb any strong odours with which it may be in contact, and furthermore, the accuracy and efficiency of chemical apparatus cannot be preserved if it is kept in places where manufacturing operations are in progress. Since the testing work will almost certainly be in the hands of the master baker or some confidential assistant, the attachment of the laboratory to the office is both convenient and desirable, as tending to keep the control work compact and centralized. So much must depend upon the peculiar circumstances in every instance, that only a few general hints can be given for guidance in selecting a room. It should be as light and airy as possible, with a good window facing north or north-west for preference. If it can be obtained at the top of the house it is well, for this will avoid creating any nuisance to other occupants, ensures privacy, and usually permits of obtaining better lighting. The presence of a good fireplace is an advantage, for such a place can be fairly easily adapted to form a draught chamber for ignitions and other operations producing fumes.

Having decided upon the location, the walls should be stripped of paper, and, after stopping any holes, both walls and ceiling should be painted with three coats of zinc white. This will greatly improve the lighting, and no change of colour need be feared by the action of chemical fumes. If cost is of great importance, the painting may be done with one or other of the water paints or washable distempers now on the market, using a white or stone colour; the resulting surface will not be so good as an oil colour, however. Before commencing to paint, it may be advisable to have benches erected if much fixing to the walls is contemplated. The best material for flooring is cement or asphalt, for in such cases simple washing removes all dirt, and chemicals do not attack these materials. In most cases, however, the ordinary wood flooring will have to suffice. For the purposes of a food laboratory, covering the floor with good plain linoleum is advantageous and practically without danger. The surface can be easily kept clean by washing, and there are no crevices for dirt to accumulate.

Preparation of Room.

The best arrangement of benches consists in running them round the four walls, leaving the centre of the room open. Where the centre space is very large a table may be put in with advantage, but care must be taken to allow sufficient space all round between the benches and table to move about comfortably. Benches should be about 4 ft. in height, with a top not more than 2 ft. 6 in. in width. If possible, have the bench top in teak; but if soft wood must be used, a thickness of $1\frac{1}{2}$ in. will suffice, and such wood should be impregnated. The following solutions are suitable for this purpose:—

Benches.

Solution I

$$\left.\begin{array}{l}\text{4 oz. aniline sulphate}\\ \text{2 oz. ammonium chloride}\end{array}\right\}\text{dissolved in 3 oz. water.}$$

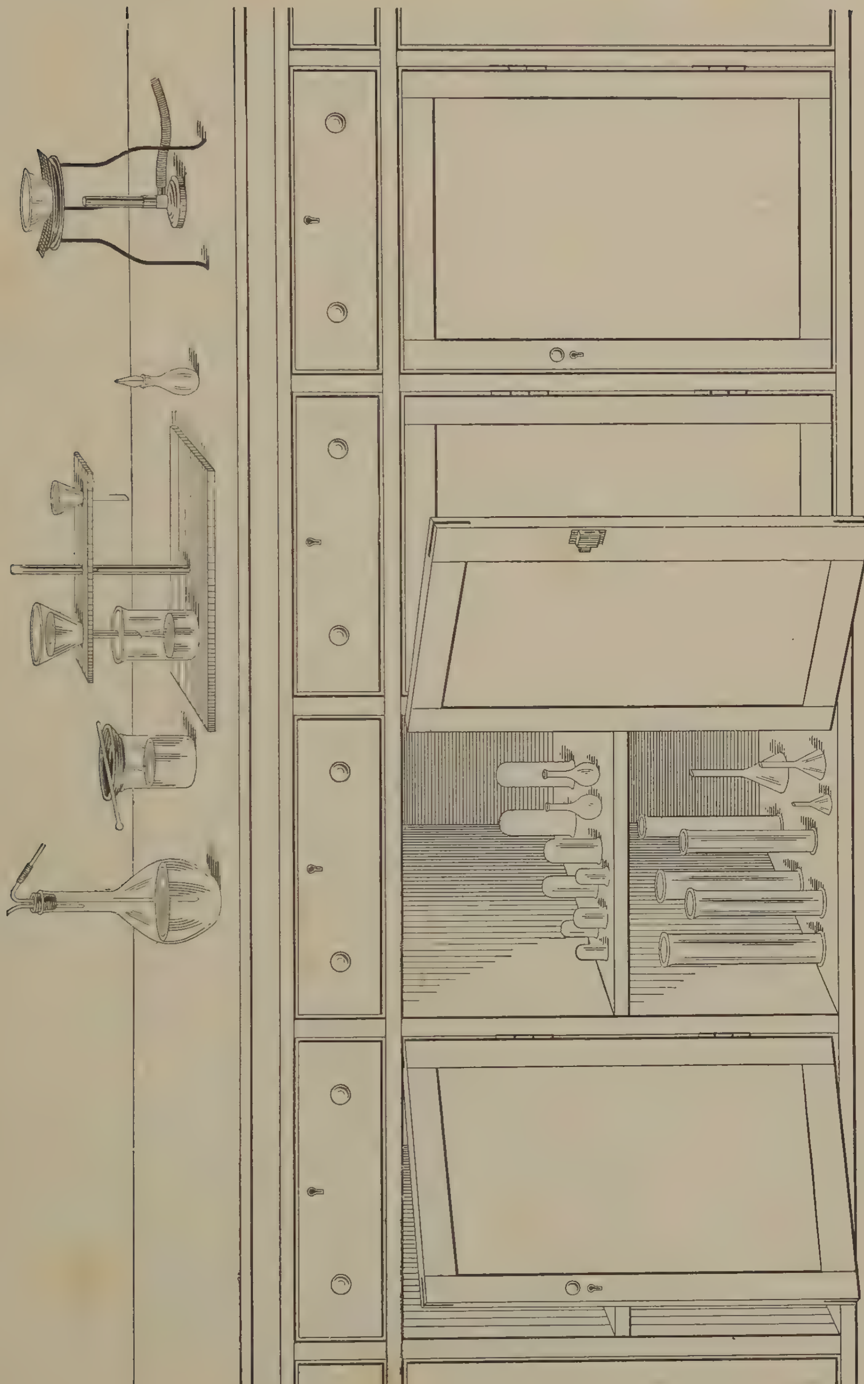


Fig. 246.—Laboratory Bench with Cupboards

Wash the bench thoroughly with the solution, and allow to dry. Afterwards apply

Solution II

4 oz. copper sulphate (blue vitriol) }
2 oz. potassium chlorate } dissolved in $1\frac{1}{4}$ pt. water.

Repeat the applications in the order named until the desired colour is obtained; then wash well with soap and water. Wood thus treated resists chemicals, and is said to be fireproof.

Fig. 247.—Bunsen Burner

The space underneath the benches is very useful for storing apparatus, reagent bottles, &c. A shelf should be run round the entire length. The provision of doors to the front, so as to convert the lower portion into a series of cupboards, greatly improves the tidy appearance of the room (fig. 246). Immediately under the bench top is an excellent position for drawers, and two or three should be provided for keeping corks and small tools.

One source of supply for both lighting and heating purposes is best; and since in most places electricity is too expensive to use as a heating agent, gas will generally be found most convenient. The service pipe should be led round at least three sides of the room about 1 ft. above the bench top. At frequent intervals T's should be inserted, so that short lengths of pipe can be put in to make the various connections to burners. Of course gas cocks must be put on at every T, so that each burner can be used and regulated without interfering with others. For supplying Bunsen burners (fig. 247) upon the bench, lengths of indiarubber tubing are usually employed, but there is somewhat less danger of accident when the flexible metallic tubing which can now be obtained so cheaply is used. This tubing, however, suffers from the disadvantage of a slight loss of flexibility in sharp curves. Acid and other corrosive fluids attack the metal tubes, unless copper ones are purchased. The gas for lighting should be carried up the wall at convenient intervals, and rigid brackets carrying inverted incandescent-mantle burners should be used. By this means the light is brought well over the work, and inconvenient shadows are avoided. For heating, several Bunsen burners will be wanted, and a couple of tripods and retort stands (fig. 248) are needed to rest apparatus upon during heating operations.

Lighting and Heating.

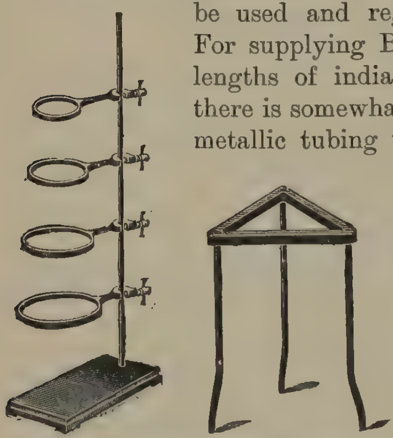


Fig. 248.—Retort Stand and Tripod

For conducting burning operations, such as ashing foodstuffs, Kjeldahl's process, and for work entailing the production of much steam, gas, or other

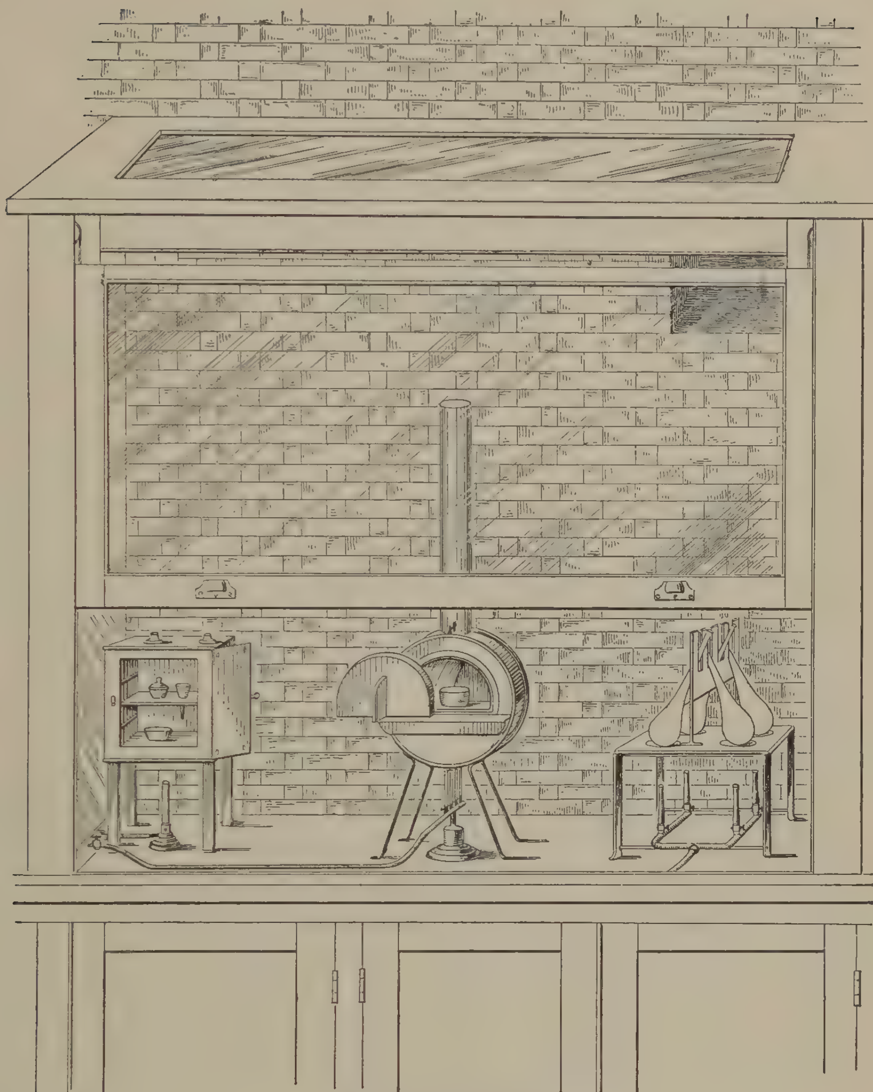


Fig. 249.—Fume Chamber

vapour, a hooded chamber with a chimney to the open air is absolutely necessary. If there is a fireplace already in the room, it is possible to make a very serviceable substitute for the ordinary fume chamber by fixing a light metal hood (such as is used in kitchens over gas stoves) to the chimney above the mantel, and leading the fume pipe through the breast of the chimney. A bench must be placed beneath the hood for apparatus to stand upon, the bench top being covered with stout sheet lead. Carry at least two supplies of gas to this bench. If no chimney is available, then one corner of the room must be set apart and converted into a fume chamber somewhat in the fashion illustrated in fig. 249.

Fume Chamber.

A plentiful supply of water is indispensable, and there should be at least two faucets, so that condensing operations can be carried on without stopping the supply of water for other purposes. A good deep sink is necessary, the best form being about 2 ft. 6 in. × 2 ft. × 1 ft. deep. Doulton salt-glazed ware is very suitable. The drain from this sink must not be trapped, but the waste should be conducted by lead pipe, as much as possible without bends, and made to discharge over a rainwater gully. Surround the sink with a wooden bench, so that glass apparatus can be rested beside the sink during cleansing. The bench running in front of the window must on no account be occupied by permanent apparatus. It should be kept for examinations requiring a good light, such as colour tests, microscopic work, and all temporary operations.

Water Supply.

The usefulness and tidiness of a laboratory depend largely upon the amount of shelf space it possesses. Nothing looks worse than benches littered with apparatus which is not in use. Whilst work is in progress, the studied disorder of the apparatus is as necessary as it is impressive, but this is a totally different thing from the confusion of a place where nothing has its appointed situation. A double row of narrow shelves should be placed along one side of the room just above the bench. These shelves ought to be about 4 in. wide and 1 in. thick, a distance of 6 in. being allowed between each two to permit of bottles being readily withdrawn. One part of these shelves should be set apart for the liquid reagents in everyday use, and the other portion may be reserved for storing the stock of dry chemicals. All concentrated liquid chemicals ought to be kept in a cool, dark place; one of the cupboards underneath the benches is most convenient.

Reagent Shelves.

The quantity of apparatus necessary to equip a laboratory will, of course, depend entirely upon the range of work it is proposed to undertake, so that it is impossible to lay down any hard-and-fast rules upon this point. It is, however, fairly easy to say what things cannot be dispensed with if work is to be done worthy of the name, and it must then be left to the individual requirements to add those things which are deemed most useful as time reveals the need. For the purposes of bakehouse testing a good physical balance, such as is figured on p. 70, Vol. I, will be found all that is required. It is, however, strongly recommended that an air-tight case should be provided for it. A good case can always be had from the dealers at the time of purchasing at a very moderate cost. The balance is a delicate instrument, and every care requires to be taken to prevent the mischief caused by dust and damp, if it is to be kept in accurate working condition. A dirty, ill-adjusted, insensitive balance vitiates every experiment and falsifies every determination. Take care, therefore, of your balance, as the most delicate piece of mechanism in your possession. The balance needs to be kept on a firm stand in a permanent position free from vibration.

Balance.

A bracket fastened to the wall is pre-eminently the best arrangement, for this isolates the instrument from tremors and vibratory movements in the room. The situation must be such that a good light falls upon the front of the balance—that is to say, the light should come from the side or rear of the operator. It is well to have a small drawer under the bracket, in which a camel-hair brush, weights, watch-glasses, and labels can be kept. A set of weights suitable for the work is shown in the illustration.

Water Oven.

The accurate determination of moisture in flours, sugars, &c., and the drying of glutens, require the provision of a drying chamber which can be kept at a constant temperature of about 100° C. for any length of time. Water ovens in a variety of sizes can be purchased from any dealer. For ordinary purposes a copper oven, about 10 × 8 × 8 in., will be found large enough. If an oven with a constant-level arrangement is purchased, connections will need to be made to supply water and an overflow to the drain. The oven then becomes perfectly automatic, and cannot run dry or become leaky. If the oven does not possess this attachment, care must be taken to see that it always has plenty of water in it. The oven should be kept in the fume chamber, so that escaping steam is led out to the open air.

General Apparatus.

A set of stoppered reagent bottles will be required for keeping the testing solutions. About two dozen narrow-mouthed bottles of 125 c.c. ($4\frac{1}{2}$ fl. oz.) capacity will be sufficient for most purposes. A similar number of wide-mouthed bottles will be found very useful for storing reserves of the various chemicals. These bottles should be neatly labelled—plain gummed labels will do—and the name of the reagent should be plainly written thereon, after which the label should be sized and finally varnished. A good supply of beakers in various sizes, boiling flasks, and test tubes, with a test-tube rack, must be laid in. These articles are inexpensive, and a plentiful supply will often avert the annoyance of having to throw away some test or experimental solution before apparatus can be obtained for fresh work. The test tubes should not be too small; $6 \times \frac{5}{8}$ in. is a good working size. For gluten determinations a number of white dishes about 4 in. diameter are absolutely necessary. These may be procured in enamelled iron, and are very durable. The porcelain ones are certainly neater, but they are so fragile that accidents are likely to be frequent. Some shallow iron dishes filled with sand, and a few pieces of wire gauze, will be needed for resting dishes and beakers on during heating. For the filtration of solutions from solid materials a few funnels of various sizes, with a small funnel stand, will suffice. A supply of filter papers must also be laid in.

Burettes.

A very large number of determinations in analytical chemistry depend upon the accurate measurement of liquid volumes, and for this purpose accurately graduated apparatus is obtainable from the dealers. The burette is one of the most important of these instruments. It consists of a long, narrow tube, graduated throughout its length

into cubic centimetres, generally subdivided into fifths. The most useful size is 50 c.c. These burettes are provided either with glass stopcocks or with indiarubber and pinchcock jets. The glass stopcocks are capable of use with all solutions, if kept carefully lubricated, but the pinchcocks must only be used for solutions which do not decompose in contact with indiarubber. The food chemist is called upon frequently to determine very small amounts of acidity in various materials, and for this end an extremely dilute solution of alkali is used, generally $\frac{1}{10}$ or $\frac{1}{100}$ normal soda. For this purpose it is very convenient to have a burette and solution constantly ready for use. The illustration (fig. 250) shows such a burette for constant supply of the reagent. The burette with a two-way stopcock and side-filling tube can be purchased ready-made, and it is only necessary to connect, by means of glass and indiarubber joints, to a reservoir bottle containing the stock solution, kept on a shelf above the burette.

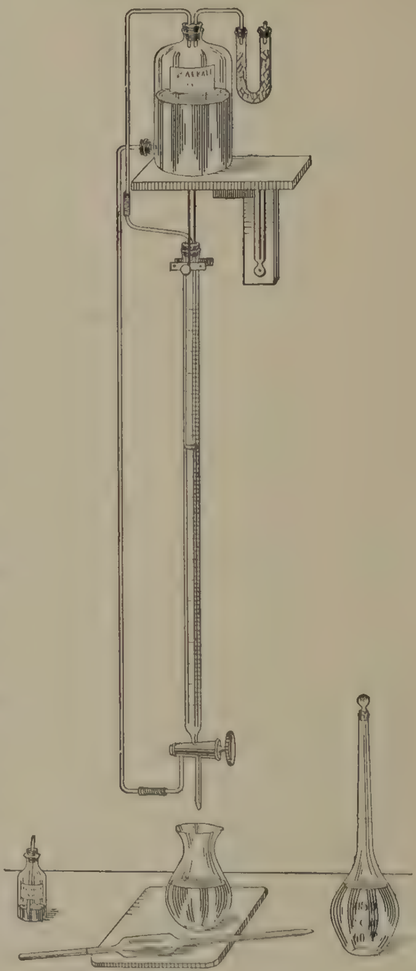


Fig. 250.—Burette

Pipettes. Pipettes are thin tubes with large bulbs in the middle. They are made in various capacities to measure definite volumes accurately. For ordinary purposes about six should be ample, and the respective volumes should be 1 c.c., 5 c.c., 10 c.c., 20 c.c., 25 c.c., and 50 c.c. For the larger volumes, and for making up standard solutions, measuring flasks are indispensable.

Measuring Flasks. They consist of very thin, pear-shaped flasks, with long, narrow necks, upon which is engraved a line indicating the point to which the flask must be filled in order to contain the required volume. The flasks are always engraved upon the bulb with the reputed volume, and also with the temperature which the liquid must attain for the measurements of the flask to be correct. A 100-c.c. and a 250-c.c. flask will be found the most useful sizes to procure. They should be provided with glass stoppers.

Measuring Cylinder. In addition to the foregoing, one of the most useful pieces of apparatus is a measuring cylinder, which is really a long tube with a foot and a spout, graduated throughout its length into cubic centimetres. One with a capacity of 100 c.c. will be constantly called for.

Other special graduated apparatus are also required for yeast-testing and flour-stability trials. The cylinders for testing the strength of flour have flat tops, and are generally known as gas jars. They should have a capacity of about 400 c.c., and should be graduated from the foot upwards to at least 350 c.c. (see p. 85, Vol. I). For testing the volume of gas yielded by a sample of yeast a suitable apparatus is shown in fig. 8, p. 86, Vol. I. The baths required for this apparatus should be procured at the same time as the cylinder and bottles.

Yeast-testing Cylinders.

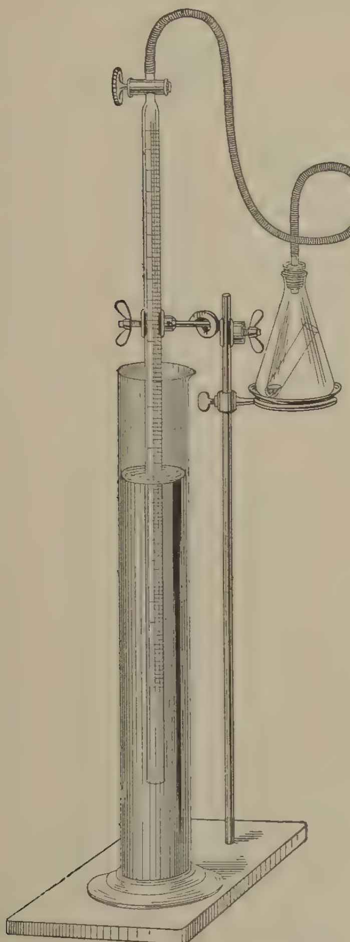


Fig. 251.—Gas-measuring Apparatus

Next to yeast the baker depends very largely upon baking powder as an aërating agent, yet it is safe to say that no substances he uses are liable to more variation or grosser adulteration than the many compounds marketed for this purpose. The fluctuations in gas-producing powers of many of these substances are so great that to this cause alone is doubtless to be ascribed many of the difficulties which occur when changes are made in the material used or fresh stocks purchased; yet bakers seldom think of testing their baking powders for strength. The process is quite simple, and should be capable of accomplishment by any practical man, especially as the only object sought is a comparison between similar materials and not an absolute figure. If it is desired, the gas apparatus shown at fig. 8, p. 86, Vol. I, can be adapted to this purpose, but a simpler and more elegant instrument can be devised with the burette and measuring cylinder, as is shown in the accompanying illustration (fig. 251). Essentially the apparatus consists of a 50-c.c. burette inverted in a cylinder of water so that it can be made to measure a volume of gas instead of liquid. There is a short, ungraduated space at the stopcock end of every burette, and the volume of this space must be determined once for all by filling to the bottom graduation with water and then running the water out into a measuring cylinder. This volume for a 50-c.c. burette will generally be found to be about 4 to 5 c.c., and it will have to be added to every gas reading taken. Fit the apparatus up exactly as shown in the figure, connecting the jet of the inverted burette by means of a piece of indiarubber tubing to a small Erlenmeyer flask provided with a rubber stopper having

Testing Baking Powders.

a small piece of glass tubing passing through it. To use the apparatus, weigh out 1 gm. of the mixed baking powder and place it in the dry flask; then gently lower a small test tube containing about 10 c.c. of water into the flask, taking care not to spill any water on to the powder. Insert the stopper. By means of the rubber tube suck up water into the burette to just fill it completely, then close the stopcock, and attach the small flask. Make sure that your rubber joints are quite air-tight, by means of string ligatures if necessary; this is not required if the rubber tube fits the glass tube quite tightly. Open the stopcock so as to connect the burette with the flask, and then gently tilt the flask until the water runs out upon the powder. In some cases gas will be evolved immediately, and the water in the burette will begin to sink in consequence. Wait until the action ceases and then gently warm the flask so as to complete the reaction. With some powders considerable heat may be necessary to accomplish this end. When all the gas is evolved allow the apparatus to cool to the ordinary temperature again, and then note the gas volume in the burette. In order to do this accurately, it will be necessary to move the burette up or down until the level of liquid inside and outside is the same. The number of cubic centimetres of gas is ascertained by subtracting the reading at the water levels from 50 and adding the constant for the ungraduated portion. For the purposes of the practical baker this volume should be compared with that which would be yielded by an ideal cream-of-tartar baking powder. On reference to Vol. I, p. 241, an equation will be found which represents the reaction occurring between pure cream of tartar and sodium bicarbonate, and from it may be calculated the theoretical yield of carbon dioxide. When this is done it is found that about 16 per cent of the weight of mixed chemicals should be given off as gas. In practice, however, it is found that perfectly pure chemicals cannot be obtained, and 13 per cent of gas is a more correct figure to adopt as a standard. This figure, converted into gas volume, gives us 68 c.c. as the approximate volume, at 15° C. and 760 mm. barometric pressure, yielded from 1 gm. of mixed powder. This is sufficiently good for all working purposes to adopt as a standard to which the volume yielded by 1 gm. of any other powder can be referred, and the closer the volume approaches this figure the better the powder will be. Powders having much starch mixed in them will, of course, yield much lower figures than are quoted above

Testing Cream Powders.

When cream powders or cream of tartar are purchased separately to be mixed with sodium bicarbonate by the buyer, a different procedure is adopted to test the value of the acid agent. This consists in weighing out a definite quantity of the powder, generally about 1 gm., and dissolving in distilled water in a beaker. A drop or two of phenolphthalein indicator is added to the solution, and then standard soda solution is run in until the colour of the solution becomes just permanently pink. The number of cubic centimetres of standard

soda solution required to accomplish this is ascertained, and from it the quantity of sodium hydrate neutralized can then be calculated. Every 40 parts of sodium hydrate neutralized represents 84 parts of sodium bicarbonate which is required to be mixed with the cream powder in order to utilize its gas-evolving power completely.

Perhaps one of the most useful things to know respecting foodstuffs

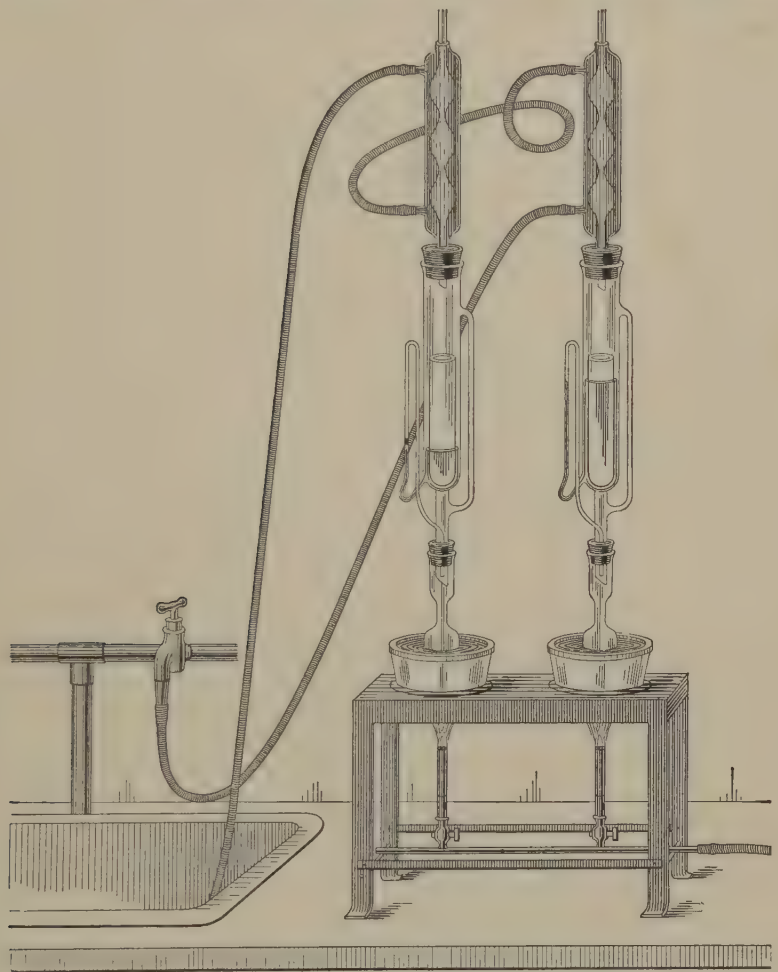


Fig. 252.—Soxhlet's Fat-extraction Apparatus

is the amount of fat contained in them. Not only is fat a most important constituent of our dietary, but, owing to its relatively high price compared with the other components of a food, it is also of considerable commercial importance to know how much is present in any given food. Among bakers its presence in bread often gives rise to the keenest of controversy, and it is therefore desirable to know how this very important yet modest compound can be detected and if

Determination of Fat.

necessary determined. Although a great variety of special apparatus has been devised for the extraction of fats, they all depend upon the principle of treating the substance for examination with some volatile solvent capable of dissolving fats but no other substances from the material. The apparatus which has received the widest application is that of Soxhlet (fig. 252). It consists essentially of three parts: (1) a small flask which contains the solvent; (2) a specially designed extraction tube provided with siphon for automatically conveying the solvent and extracted fat back into the solvent flask, and also with a tube for conveying freshly distilled solvent on to the material for extraction; (3) a condenser to prevent escape of the solvent. In order to carry out the operation the material for extraction must be free from moisture, and therefore all materials should be carefully dried in the water oven before attempting to determine the fat. A weighed quantity (1 to 5 gm.) of the substance for examination is introduced into the extraction tube, seen in the middle of the illustration, the solvent flask is filled to the mark with dry ether, and the whole apparatus is then fitted together so tightly that ether cannot escape from the stoppers. The condenser is filled with water, which must be kept circulating during the whole of the process, so as to ensure complete condensation of the distilling ether. When all is complete the flask containing the solvent is heated gently in a water bath until the ether distils at a slow but regular pace. Allow the solvent to circulate through the extractor at least twelve times. Then remove the small flask, distil off the ether, dry in the water bath for about one hour at 100° C., and finally weigh. The increase in weight over the weight of the perfectly clean dry flask will be due to the fatty matter extracted from the material under examination, and the percentage can be found by simple proportional calculation. Although the method is quite simple in principle, still it requires great care and attention to the details for its successful application. There should, however, be no difficulty in obtaining good results if the work is carefully performed.

Determination of Proteins—Kjeldahl's Process.

Next in commercial importance to fats as food constituents come the proteins. All these bodies contain nitrogen, the most familiar examples of the class being white of egg and gluten. The determination of proteins is now usually accomplished by the simple and accurate method originally devised by Kjeldahl. The nitrogen is converted into an ammonium salt, and the amount of ammonia determined by simple volumetric methods. To carry out this process about 1 gm. of the substance is weighed out and placed in a long-necked hard-glass flask, 20 c.c. of concentrated sulphuric acid is added, and the mixture heated for one hour on a sand bath in the fume chamber. At the end of this time add 10 gm. of potassium sulphate, and continue heating over a naked flame until the black liquid becomes almost water-white. Allow to cool, and then add 200 c.c. of distilled water, transfer to a large distilling flask, and add a slight excess of caustic soda. Connect to a vertical Liebig condenser, and distil over

about 150 c.c. into a receiver containing 50 c.c. of standard sulphuric acid. The distilling apparatus is shown in fig. 253. When the distillation is finished, transfer the distillate to a graduated measuring flask (250 c.c.) and make the volume up to the mark. This solution is next titrated with standard caustic soda solution. If $\frac{N}{10}$ solutions are employed for the sulphuric acid and caustic soda solutions, then 1 c.c. soda is equivalent to 1 c.c. acid. Find the number of cubic centimetres of soda required to neutralize the 250 c.c. of distillate, and this number will represent the number of cubic centimetres of sulphuric acid remaining uncombined of the 50 c.c. originally taken. Subtract from 50, and the number remaining will be the cubic centimetres of acid which have combined with ammonia liberated from the material under test. Since we are using $\frac{N}{10}$ solutions, then the cubic centimetres of acid neutralized will be equal to the same number of cubic centimetres of $\frac{N}{10}$ ammonia solution, each cubic centimetre of which will contain ·0017 gm. of ammonia gas or ·0014 gm. of nitrogen. By multiplying the cubic centimetres of $\frac{N}{10}$ acid absorbed by ·0014, therefore, the amount of nitrogen in the weighed quantity of material originally taken is found. To convert this nitrogen into proteins it is usual to multiply the weight by the factor 6·25, since it is found that the amount of nitrogen in proteins of all kinds averages 16 per cent. There is no great difficulty in carrying out Kjeldahl's process; and though at first it may seem complicated, yet in practice it will be found quite easily and rapidly performed. It also has the advantage of yielding very reliable results.

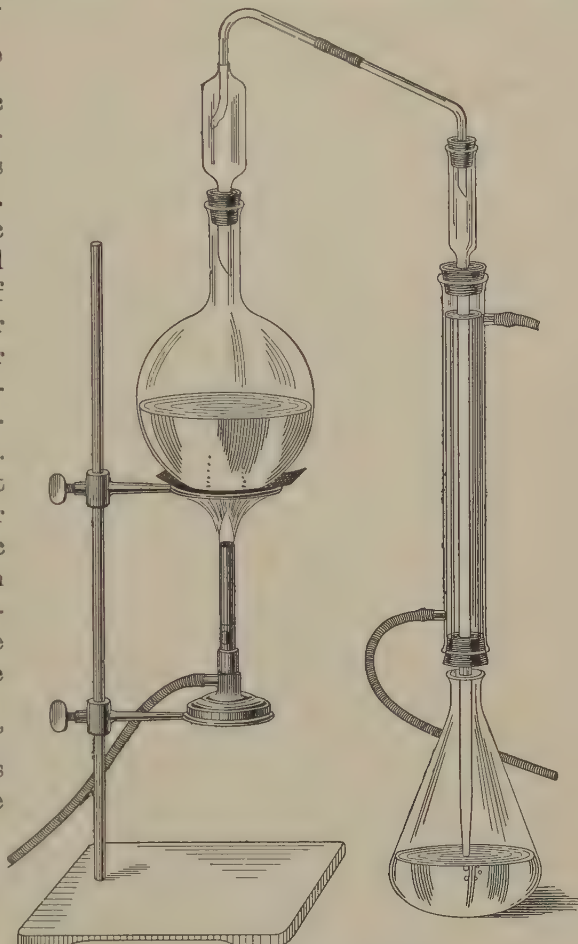


Fig. 253.—Condensing Apparatus

The carbohydrates cannot all be determined by any single process, though frequently results were given in the past in which all were determined as dextrose after conversion by means of acid. This system of recording results is now almost abandoned. For sugars the best mode of determination is by means of Fehling's solution (see p. 110). This solution, when acted upon by most sugars, on heating throws down a precipitate of cuprous hydrate, the quantity of which is proportional to the amount of sugar present and its specific nature. There are two principal modes of using Fehling's solution, viz. gravimetric and volumetric. Both methods have their advocates, but perhaps the gravimetric requires the smaller amount of specialized training for its successful application. A solution containing not more than 2 gm. per cent of the sugar for examination is made. Measure out into a beaker equal volumes of each of the Fehling solution constituents sufficient to make about 30 c.c., place in a boiling-water bath for a few minutes, and note whether any reduction takes place. If there is any, it must be determined, and a correction applied to every test made with the solutions. If there is no precipitate, add a known volume of the sugar solution and replace in the water bath for twelve minutes. Remove and filter off the red precipitate through a small tough filter. Wash with hot distilled water until the filter paper is quite free from green colour, and the wash water is no longer alkaline. Then dry the filter paper. Burn in a crucible, and weigh the residue of copper oxide obtained, deducting the weight of the filter ash. From the volume of solution required to yield the observed weight of copper oxide find the amount of oxide to which the whole solution is equal, and by reference to the following figures it will be possible to find how much of the following sugars this represents. It has been found that

Fehling's Solution for Sugars.

1 gm.	maltose	reduces	1·345	gm. CuO.
1 „	lactose	„	1·680	„
1 „	dextrose	„	2·205	„

In carrying out this process care must be taken that the whole of the Fehling's solution is not reduced. This is guarded against by noting that the solution is still deep-blue after reduction is complete. If this is not the case, and the solution is green or yellow, reject the test and make another, adding a proportionally smaller quantity of sugar solution.

Testing Cane Sugar and Starch.

It is not possible to test cane sugar or starch by this method. Cane sugar, however, is readily converted into dextrose by means of dilute acid, after which it may be tested as above. Starch is converted into glucose by prolonged heating with acids, and, after neutralizing the acid, may be tested with Fehling's solution. It is more often the rule, however, to determine all other carbohydrates directly as above, and then to take starch as constituting the difference. Mixtures of sugars cannot, of course, be determined by the simple process outlined above, and reference must be made to works dealing with sugar analysis for the many methods adopted in such cases.

Determination of Ash.

The determination of mineral matter or ash is a matter of some importance, since it is frequently possible to gain some information as to the grade of a flour from the amount of ash obtained by incineration, whilst the presence of mineral adulterants can always be detected by this means. A muffle furnace is the best apparatus for burning off the organic matter, because no loss of volatile ash is likely to occur. The operation can be performed in the open air by means of a Bunsen burner if the muffle is not at hand, but it is productive of much fume, and the charcoal formed often requires very prolonged heating for its complete combustion. The material to the extent of about 5 gm. should be weighed into a platinum dish for preference, but a nickel or even a porcelain dish can be used. The dish and contents are then heated to bright redness until only a white ash remains. On weighing the dish after cooling, the increase over the weight of the empty dish is due to ash; and since 5 gm. had been taken for the test, it will only be necessary to multiply by twenty in order to obtain the percentage of ash.

Determination of Moisture.

All food materials contain a greater or less amount of moisture, and since the value depends entirely upon the dry matters present it is very important to know how much of this water exists in any given sample. For instance, the moisture of flour may legitimately vary between 11 and 14 per cent, and this means that the moister flour contains 8·4 lb. more water per sack than the dry one. The influence of this moisture on the water-absorbing property of a flour will be readily appreciated. For the determination of moisture it is only necessary to weigh out 5 gm. of the material into a weighed watch-glass or small dish. Place in the water oven for six hours, keeping the water in the oven gently boiling all the time. Then remove, cool in a desiccator, and weigh. The loss in weight multiplied by twenty will give the percentage of moisture.

List of Reagents.

The following stock reagents will be sufficient for all ordinary purposes in the bakery testing room:—

Sulphuric acid, pure, 1 lb.	Ammonic oxalate, 4 oz.
Hydrochloric acid, pure, 1 lb.	„ chloride, 1 lb.
Nitric acid, pure, 1 lb.	„ carbonate, 1 lb.
Ammonic hydrate, pure, 1 lb.	„ molybdate, 2 oz.
Sodic hydrate, pure, 2 lb.	Iodine, 1 oz.
Alcohol, methylated, 2 lb.	Potassic iodide, 4 oz.
Ether, methylated, 1 lb.	Silver nitrate, 1 oz.
Chloroform, ½ lb.	Baric chloride, 1 oz.
Copper sulphate, 1 lb.	Methyl orange, ½ oz.
Rochelle salts, 1 lb.	Phenolphthalein, ½ oz.
Potassic sulphate, 1 lb.	Potassic ferrocyanide, 4 oz.
Logwood chips, 4 oz.	Methyl violet, ½ oz.
Acetic acid, 1 lb.	

This list will, of course, need to be augmented as requirements arise. A sufficiency of distilled water should always be at hand, for all chemical

tests require to be made with distilled water. Working solutions must be made from the concentrated chemicals received from the dealers. Dilute acids are made by mixing 1 volume of concentrated acid with 4 volumes of distilled water. Care must be exercised in diluting sulphuric acid always to add the acid to the water, and not vice versa; stir constantly. Dilute ammonia is made by mixing 1 volume of ·880 ammonic hydrate solution with 3 volumes of water. The solid chemicals may be conveniently dissolved in distilled water in the proportion of 5 parts in 100 of water. There are a few exceptions, which will be noted in the section devoted to special reagents.

Standard Solutions. One of the most useful methods of quantitative analysis consists in the use of dilute solutions containing definitely known weights of active chemical reagent in a fixed volume. If a solution is made of such strength that its chemical activity is equivalent to that of 1 atom of hydrogen, then it is called a normal solution, usually written N. So also if the strength is equal to $\frac{1}{5}, \frac{1}{10}, \frac{1}{2}$ that of 1 hydrogen atom, then the solution is $\frac{N}{5}, \frac{N}{10}$, or $\frac{N}{2}$ respectively. In food chemistry two solutions of $\frac{N}{10}$ strength are capable of such wide application, that short directions for their preparation are here given. Should other solutions be required, a manual of volumetric analysis must be consulted for details of preparation.

N Sulphuric Acid. For N sulphuric acid measure out about 30 c.c. of pure sulphuric acid (sp. gr. 1·84) into a thin beaker, and dilute with distilled water to about 900 c.c. This is best done by pouring the acid in a thin stream into the beaker nearly filled with water. Cool thoroughly, and transfer to a litre flask. When cold, make the volume exact with water. This would, if the acid were perfectly pure, give a solution a little stronger than normal. It is necessary, however, to ascertain exactly the strength of the solution. The process is as follows. Weigh out 5 gm. of recently ignited sodium carbonate and dissolve in 100 c.c. of distilled water, making the volume exact in the 100-c.c. measuring flask. Fill a burette with the acid solution for testing, and into a beaker place 20 c.c. of the soda solution, adding a couple of drops of methyl orange. Carefully read the volume of acid in the burette, and then run in the acid solution on to the soda solution until the yellow colour is just permanently changed to red. This indicates that the soda has been neutralized by the acid used. From the following equation,

$$Na_2CO_3 + H_2SO_4 = Na_2SO_4 + H_2O + CO_2,$$

it can be calculated that 53 parts of the alkali sodium carbonate just neutralize 49 of sulphuric acid, and these figures, in conjunction with the observed quantity of acid required to neutralize exactly the whole of the sodium carbonate originally weighed out, will form the basis upon which a calculation of the standard strength of the acid can be built. For example:

By experiment it was found that 20 c.c. of a 5-per-cent solution of sodic carbonate required 18·5 c.c. of the prepared sulphuric acid for its neutralization. Therefore 100 c.c., *i.e.* 5 gm. of sodic carbonate, require 18·5 × 5 = 92·5 c.c. sulphuric acid.

Now since

$$53\ Na_2CO_3 : 49\ H_2SO_4 :: 5 : x \text{ grams sulphuric acid,}$$

that is $$\frac{49 \times 5}{53} = 4{\cdot}245 \text{ gm. in } 92{\cdot}5 \text{ c.c.;}$$

therefore $$1 \text{ c.c. contains } \frac{4{\cdot}245}{92{\cdot}5} = {\cdot}0497 \text{ gm.}$$

The solution is therefore a trifle over exact normal strength, and requires the addition of 14 c.c. to each 1000 c.c. to reduce it to the true standard. Ascertain this strength with the utmost care, for it is upon the standard sulphuric acid that reliance is placed in testing all other solutions. If the solution is too strong, it must be further diluted; if too weak, it must be fortified. When the strength has been accurately ascertained, the solution must be put into a clean Winchester and labelled with the strength. If the solution is required $\frac{N}{10}$, as being the best strength for all-round purposes, then it must be diluted as occasion requires, until 1 c.c. of the acid solution contains just ·0049 gm. of acid. To prepare $\frac{N}{10}$ from N solutions, take 100 c.c. and make up to 1000 with distilled water.

N Sodium Hydrate.

For the preparation of N sodium hydrate, weigh out 40 gm. of pure sticks of sodic hydrate; dissolve, and make to 1 litre. Test against the N sulphuric acid already made. From the formula

$$\begin{array}{c} 2NaOH + H_2SO_4 = Na_2SO_4 + 2H_2O \\ 80 \quad : \quad 98 \end{array}$$

we obtain the ratios of the reagents, and 1 c.c. of N sodium hydrate should contain ·04 gm. of soda. Label carefully, and verify the results occasionally, making any alteration that may be found necessary owing to evaporation. Prepare $\frac{N}{10}$ solutions from the standard by diluting 100 c.c. distilled water to 1000 c.c. as in the case of sulphuric acid.

Indicators.

For volumetric work with acids and alkalies it is necessary to have certain coloured solutions which, by undergoing a sudden change in colour, can be made to serve as an index of the required action being complete. Two of the many substances suitable for this purpose will suffice for all ordinary purposes.

Methyl Orange.

Dissolve ·1 gm. of dry methyl orange in 100 c.c. of distilled water. One drop of this solution will be sufficient to add to 100 c.c. of any liquid to be tested. In acid solutions this indicator is pink to red according to the density, and upon becoming alkaline it changes to yellow. It may be used in cold solutions for all mineral

acids generally used, nitrous acid excepted, and for the alkalies, including ammonia. It is not reliable for organic acids.

Phenolphthalein.

Dissolve 1 gm. of dry phenolphthalein in 100 c.c. of 50-per-cent alcohol. This indicator is perfectly colourless in acid solutions, but becomes deep crimson immediately the solution turns faintly alkaline. The indicator is excellent for the organic acids, but is of no use for ammonia.

Fehling's Solution for Sugar-testing.

The following are directions for the preparation of Fehling's solution. Weigh out 69·28 gm. of pure crystallized copper sulphate, and dissolve in 1 litre of water. Add 1 c.c. of concentrated sulphuric acid. Place the solution in a clean Winchester quart, and label: FEHLING'S SOLUTION I. Dissolve 350 gm. Rochelle salts in 700 c.c. of water, and filter if necessary. In another 200 c.c. of water dissolve 100 gm. of caustic soda. Mix the two solutions together, cool, and make up to exactly 1 litre. Place in a clean Winchester, and label: FEHLING'S SOLUTION II. For use, equal quantities of I and II are taken and mixed together when required. The mixed solution should contain ·0346 gm. of copper sulphate in each cubic centimetre, and this when completely reduced is equivalent to ·005 gm. of anhydrous grape sugar.

Iodine Solution for Testing for Starch in Yeast, &c.

Dissolve about 20 gm. of potassium iodide in a small quantity of distilled water and place in a stoppered bottle. Then add about 5 gm. of iodine crystals, and shake occasionally until the liquid becomes almost black. For use, decant a portion of the dark-red solution into a bottle and dilute until it has a pale port-wine tint.

Logwood Solution for Alum Tests.

Digest 10 gm. of logwood chips in about 100 c.c. of alcohol; decant off the clear solution and keep in a stoppered bottle. A saturated solution of ammonium carbonate is also required; the ordinary bench reagent will do for this. The logwood tincture should be fresh, therefore large quantities should not be prepared at a time. To apply this test, weigh out 20 gm. of the flour for testing and make into a thin dough with an equal weight of water. To this add 1 c.c. of logwood tincture and 1 c.c. of ammonium carbonate; mix thoroughly. Spread out upon a white tile or piece of white paper and dry gently. If the layer dries with a blue or violet colour, alum is present. Pure flour dries to a light-pink colour. For the purpose of estimating the quantity of alum present, comparisons should be made against samples of pure flour to which varying amounts of alum have been previously added. When the suspected flour matches the colour yielded by that of a known weight of alum a fair measure of the extent of adulteration is obtained.

Tests for Bleached Flour.

When nitrous oxides have been used, it is easy to detect the treated flour by means of the Griess-Illosvay reagent. To prepare this solution, dissolve ·5 gm. of sulphanilic acid in 150 c.c. acetic acid. Then dissolve ·1 gm. a-naphthylamine in 20 c.c. boiling water, and pour off from any blue oily residue. Mix the two solutions, and if any pink colour appears, add a trace of zinc dust until it is destroyed

and the liquid is colourless. When about 1 c.c. of this solution is added to a bleached flour suspended in water, a pink colour appears which is permanent for several hours. When chlorine or bromine is used as a bleaching agent, it is detected by extracting the flour with benzol. Evaporate the solution until only an oily residue remains. If the oil is colourless or nearly so, the flour is probably bleached. Moisten a platinum wire loop containing a fragment of copper oxide in the oily fluid, and hold in the Bunsen flame. A green flame will indicate the presence of chlorine or bromine bleaching agents. If the copper oxide yields no green flame, these agents have not been used.

Mineral Adulterants in Flour.

Mineral adulterants in flour may be detected by ashing a sample, when an abnormally large ash will point to mineral matter added. Another test which is fairly reliable is to treat about 10 gm. of the flour with 25 c.c. of chloroform in a large test tube, shaking thoroughly. Then allow to stand for a few minutes. If mineral matters have been added, they will be found as a precipitate at the bottom of the tube, whilst the flour will be on the top of the chloroform. This test makes use of the different specific gravities of flour and its possible mineral adulterants.

Vogel's Test for Unsound Flour.

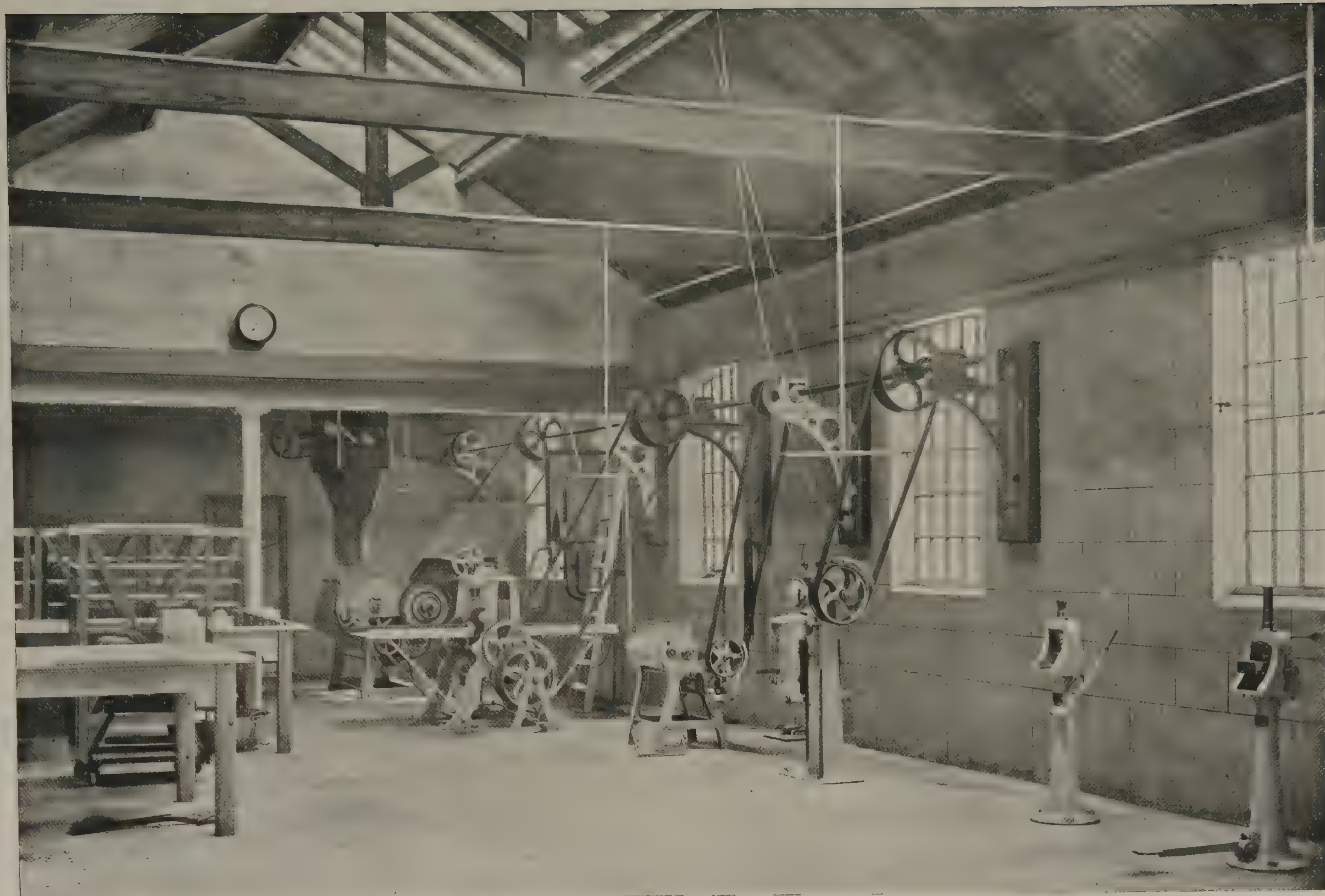
Digest about 20 gm. of the flour with 70 per cent alcohol containing 5 per cent hydrochloric acid. Allow to stand one hour and then examine the clear solution. A perfectly colourless solution is obtained from pure wheaten flour. Blood-red colour is yielded by wheaten flour containing ergot, and purple-red if mildewed. Yellow colour is due to barley or oats, and orange-yellow to pea flour.

Detection of Sprouted Wheat, &c.

Stain a portion of the flour with methyl violet. Smear a trace on a microscope slide and put on a cover glass. Examine with $\frac{1}{4}$-in, or $\frac{1}{6}$-in. objective. Any starch grains which have been damaged either by sprouting of the wheat, mildew, ergot, or even by excessively high pressure in the mill rolls, will be stained deep blue, whilst the sound starch will remain colourless. The reagent is prepared by digesting 1 gm. of methyl violet in about 50 c.c. of absolute alcohol until the solution is saturated. Then take 11 c.c. and add 100 c.c. of distilled water. This stain can also be used for examining flour or bread for yeast and bacteria. The organisms take up the dye and become quite distinct when viewed with the $\frac{1}{8}$-in. or $\frac{1}{12}$-in. objective. It is necessary, however, to first ensure that the organisms are dead, as when living they do not take stains. To do this, mix a little of the bread or flour with a few drops of water in a watch-glass. Transfer a drop of the liquid to a microscope slide and spread it out in the form of a smear. Allow to dry in the air, and then quickly pass the slide through the flame of a Bunsen three or four times. Next place a few drops of the stain upon the smear and leave in contact ten minutes, pour off, and wash once or twice in water. Place a cover glass over the stained preparation, and examine with $\frac{1}{8}$-in. lens if yeasts are being sought for, or $\frac{1}{12}$-in. oil immersion for bacteria.

The following is a list of fittings and apparatus for the testing room with prices:—

	£	s.	d.
1 chemical wall bench, 7 ft. by 1 ft. 9 in. by 3 ft., with teak top, 2 cupboards, and 4 drawers	8	0	0
2 two-way gas taps	0	6	0
1 three-way water tap	0	17	3
Gas and water pipes for connections (about)	1	2	0
1 white enamelled sink, 30 in. by 14 in. by 10 in.	1	4	9
1 acid receiver of earthenware	0	15	6
1 downpipe for above			
1 set of bottle shelves	0	8	3
1 laboratory stool	0	13	6
1 drawing board with pegs	0	16	0
1 bracket shelf for balance	1	10	0
1 balance, 100 gm.	1	18	9
1 glass case for above, with sliding door	1	3	0
1 set of weights, 50 gm.	0	5	6
1 doz. watch-glasses, 2 in.	0	1	0
1 camel-hair brush	0	0	4
3 pieces of wire gauze, 6 in.	0	0	9
3 Bunsen burners with roses	0	6	9
3 yd. indiarubber tubing (best), $\frac{5}{16}$ in.	0	6	9
2 tripod stands, 20 cm.	0	2	0
1 retort stand with rings 20 in.	0	4	9
2 clamps and bosses	0	7	6
2 burettes, 50 c.c. in $\frac{1}{10}$	0	10	9
1 burette stand for two	0	3	0
1 doz. assorted flasks	0	7	6
½ doz. flasks, 250 c.c.	0	3	0
1 doz. N.M. reagent bottles, 175 c.c.	0	4	6
½ „ W.M. „ 125 „	0	4	9
100 blank labels	0	0	6
¼ doz. pipettes, 1 c.c.	0	0	9
1 water oven with gauge tube-stand, 20 by 20 by 20 cm. ...	2	2	0
1 burner for above	0	2	9
100 filters, No. 204, 15 cm.	0	0	9
1 doz. each red and blue litmus books	0	3	0
2 thermometers, 400° F.	0	6	9
2 „ in metal case, 20 cm.	0	4	6
¼ doz. basins, No. 1	0	1	6
¼ „ funnels, 15 c.c. rib	0	1	9
½ „ „ 9 „	0	1	6
½ „ yeast flasks, 100 c.c.	0	4	6
2 measures, 18 cc.	0	1	6
1 „ 100 cc.	0	1	9
1 „ 250 cc.	0	2	4
1 lb. glass tubing (assorted)	0	1	3
1 spatula, 18 cm.	0	0	10
¼ doz. crucibles and covers, No. 00	0	1	0
1 pair of tongs, 7 in.	0	1	6
1 doz. assorted rubber corks	0	3	9
3 „ „ corks	0	1	6
1 set of six corkborers	0	2	3
3 yd. connection tubing, $\frac{3}{16}$ in.	0	4	6
1 Davies condenser, 15 cm.	0	6	9



CORNER OF RESTAURANT BAKERY

	£	s.	d.
2 Soxhlets	0	12	0
Chemicals and standard solutions (about)	1	10	0
1 special gas-collecting set, including troughs, graduated jars, bottles, &c., complete as used at the National Bakery School, London	1	10	0

CHAPTER IX

BOOKKEEPING FOR BAKERS, CONFECTIONERS, AND CATERERS[1]

It is essential in these days of progress that every kind of business should be conducted upon correct principles, and that realities alone should be the base of every shopkeeper's and manufacturer's scale of prices. The principal of every trading concern should know exactly where the division between profit and loss exists. This is attainable, not by guesswork or imagining what other persons do and make, but by taking daily records. These, if taken correctly, will furnish a true history of the past business, and will enable a satisfactory judgment to be made as to what are the business prospects of the future. Moreover, the details of these records, becoming fully realized by any master baker and confectioner, enable him to become complete master of his business, and to discover any misplaced expenditure, inadequate return, or overplus in manufacture. A greater knowledge of the financial position of the business naturally gives him greater peace of mind and less anxiety for the future. And if death should unfortunately occur, his business records will enable those who take his place to ascertain the true financial value of his business. The keeping of daily records is in itself of great value. Although at first irksome to some, it keeps the owner in actual touch with the business, and instils habits of punctuality and exactness upon which success so largely depends.

Correct Book-keeping and Business Control.

The number of books hereinafter set out, and recommended to be adopted under the varied circumstances, may appear to those whose only book kept is the Bread Ledger as excessive and unnecessary. This, however, is not the case; they are not all daily records, so that those which are not may be kept by professional accountants if such is desired. The Private Ledgers, for instance, of almost every business to which the writer is auditor are kept solely by himself, and this arrangement is generally preferred.

Necessary Books.

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[1] In the examples of accounts in this chapter no year is placed at the heads of the columns or at the beginning of a year, as it is not desirable to suggest that the prices quoted are present market rates. In actual office practice, however, it is important that the year should be given in both places.

The principal difficulty that has been experienced in adopting this system of bookkeeping seems to be that bakers and confectioners do not realize the amount it costs to keep the household. This lack of knowledge generally results in a weekly allowance being made for the household expenses, instead of money being taken from the till as required. This allowance in many cases has been totally inadequate, and great objection has been made to the system of bookkeeping, although this was in no way to blame. It is therefore desirable that when the regular method is adopted, as set out below, the actual sums expended on the household should be taken out of the till as before, but recorded in the Expenses Book. By this means the actual expenses of the house for a month can be ascertained, and, if desired, a proportionate weekly allowance made.

Household Expenses Underestimated.

The accounts which are recommended to be kept are based on two great principles. The first of these is the ratio of the cost of the goods bought to the amount realized by their sale. From this is deduced the proportion of such sales which represents cost on the one hand and *gross profit* on the other. Such gross profit should represent a fair and adequate percentage. The second principle consists in ascertaining the expense which has been incurred in placing such goods on the market, and which, when deducted from the aforementioned gross profit, will represent the *net profit* derived by the turnover. From these two principles is gathered the progress of the business. The question now arises, Has the owner benefited by his trading? or, in other words, has the business capital increased or decreased? Whether this is so or not is shown by the excess or diminution of the net profit over the total amount which has been withdrawn from the business for private expenses.

Gross and Net Profits.

Before commencing a detailed description of the system, mention must be made of the Customers' Ledger, Carmen's Rounds Books, and Customers' Books. The first-named is often called the Bread Ledger or Bakery Ledger. A very useful form, suitable to the businesses of most bakers and confectioners, is shown below. On the extreme left the names of the customers, or, more conveniently, their addresses are inserted. The balances owing are inserted in the adjoining cash column. Each day the number of quarterns delivered—*e.g.* ½, 1, 1½—is inserted in the first small column under B. Under F and S are inserted the value of the flour and small goods, respectively, which have been bought by the customer. The cash received by the carman is entered in the last small column. It is a good practice to note at the beginning of a round the number of quarterns taken each day, and to agree this with the total of the B column and the number returned to the shop. The total of the cash column should be found every day for each round, and should agree with the cash handed in. Its total should then be entered in the Takings Book, as described later. The cash received in the shop in payment of an account must be posted each day from the Takings Book to the customer's line in this ledger. This may be entered in red ink to distinguish it from the carmen's receipts.

Bread or Bakery Ledger.

COMPLETE BAKERY LEDGER

Week ending...

Names.	Owing at Beginning of Week.			Monday.				Tuesday.				Wednesday.				Thursday.				Friday.				Saturday.				Owing and Week's Goods.			Total Cash Received.		
	£	s.	d.	B.	F.	S.	Cash	B.	F.	S.	Cash	B.	F.	S.	Cash	B.	F.	S.	Cash	B.	F.	S.	Cash	B.	F.	S.	Cash	£	s.	d.	£	s.	d.

Week ending...

Balance Owing.			Monday.				Tuesday.				Wednesday.				Thursday.				Friday.				Saturday.				Owing and Week's Goods.			Total Cash Received.			Balance Owing.			
£	s.	d.	B.	F.	S.	Cash	B.	F.	S.	Cash	B.	F.	S.	Cash	B.	F.	S.	Cash	B.	F.	S.	Cash	B.	F.	S.	Cash	£	s.	d.	£	s.	d.	£	s.	d.	

Simpler Bread Ledger. For a business where only bread is sold on the rounds a very useful form of Ledger is that shown below. Each day the number of quarterns supplied and cash received—the latter often in red ink—is noted in the small columns. It is well to put the date at the head of each column.

BREAD LEDGER

NAMES.	Owing at Beginning of Week.			Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Owing at End of Week.		
	£	s.	d.							£	s.	d.

Catering Ledger. Many bakers and confectioners have an ordinary Ledger, like that described later, for keeping the accounts of debtors for hire, catering, and monthly accounts in general. The items of the bill would be entered on the debit or left-hand page, while the cash posted from the Takings Book would be entered on the credit or right-hand page.

Carmen's Rounds Book. Page 117 is a specimen[1] of the Carmen's Rounds Book corresponding to the Complete Bakery Ledger. If desired, the Remarks column can be cut off on alternate pages or otherwise, so that the customers' names can be made to stand for as many weeks as desired.

Customers' Books. Customers' Books usually consist of small books about 4 × 6 in., the covers being made to advertise the business. Each page is ruled with a cash column on the right-hand edge, and a margin for the date on the left. The balance brought from the previous week is first inserted; then the goods as supplied each day are entered from the Customers' Ledger. These are totalled, and after deducting the cash paid during the week, the balance due is arrived at.

		£	s.	d.
	Brought forward...	1	6	4
July 12	4 Quarterns at 6*d*.	0	2	0
" 13	3½ " "	0	1	9
" 13	Small Goods.........	0	0	6
" 14	4 Quarterns at 6*d*.	0	2	0
" 15	3 " "	0	1	6
" 16	4½ " "	0	2	3
" 17	6 " "	0	3	0
" 17	Cakes..........................	0	3	6
		2	2	10
" 15	Cash on A/c	1	0	0
		1	2	10

[1] The specimen page of roundsman's book on p. 254, Vol. III, refers to a system slightly different in detail from that here described.

The following is a specimen page of the Carmen's Rounds Book corresponding to the simpler Bread Ledger illustrated opposite. As this is entered up in the same manner as the latter, no further description is necessary.

CARMEN'S ROUNDS BOOK

Price per Qtn...... NAMES.	Owing, Brought Forward.			Monday.				Tuesday.				Wednesday.				Thursday.				Friday.				Saturday.				Balance Forward.			REMARKS.
	£	s.	d.	B.	F.	S.	Cash	B.	F.	S.	Cash	B.	F.	S.	Cash	B.	F.	S.	Cash	B.	F.	S.	Cash	B.	F.	S.	Cash	£	s.	d.	

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SIMPLER CARMEN'S ROUNDS BOOK

Price per Qtn...... NAMES.	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	REMARKS.

Customers' Bills. As nearly every baker and confectioner has his customers' bills printed according to his own fancy, little need be said about them. Below is reproduced a specimen of a neat and useful ruling for the lower portion of the bill.

			£	s.	d.
19.......					
Bill delivered....................................					
	Bread.	Flour.			
Monday........................					
Tuesday........................					
Wednesday..................					
Thursday......................					
Friday..........................					
Saturday......................					
Fancy Bread....					
Rolls..................................					
Biscuits..............................					
Cakes..................................					
Pastry................................					
Small Bread...................... ..					
Buns..........					
Jams and Jellies..................					
			£		

Primary and Secondary Books. The books required by an average baker and confectioner, in addition to those described above, naturally divide themselves into two classes. In the one are placed those whose entries constitute the basis upon which the system rests. These may be called the Primary Books. In the other class must be included those whose items are postings or entries from the Primary Books. These may be styled the Secondary Books. The necessary Primary Books are: 1. Expenses Book; 2. Takings Book; 3. Cash Book; 4. Journal or Day Book; 5. Stock Book; whilst the Secondary Books which have been found most useful are: 1. Analysis Book; 2. Ledger; 3. Private Ledger. In giving a detailed account of each of these books, the most natural order will be to follow each Primary Book with the Secondary Book to which it forms a basis. Following this rule, the order of the books will be as follows:—

Primary	...	...	1. Expenses Book.
Secondary	...	...	2. Analysis Book or Analytical Journal.
Primary	...	...	3. Takings Book.
,,	...	...	4. Cash Book.
,,	...	...	5. Journal.
Secondary	...	...	6. Ledger.
,,	...	...	7. Private Ledger.
Primary	...	...	8. Stock Book.

Double Function of Some Books. It is necessary to state that the Cash Book, although acting as a Primary Book, in that it records the cash banked and cheques paid, yet holds the capacity of Secondary Book towards the Takings Book. Moreover, since the Stock Book is only used

when the books are balanced, its discussion will more appropriately follow that of the most important book, viz. the Private Ledger.

Keeping Track of Entries.

It may be here noted that, for the sake of reference, when a payment is entered or posted to another book, or even to another account, the number of the page or folio to which it is posted must always be inserted opposite the amount, and above it should be placed a small abbreviation denoting the book in which the entry is to be found. The abbreviations most common are: Analysis Book, A.B., or Analytical Journal, A.J.; Cash Book, C.B.; Journal, J.; Ledger, L.; Private Ledger, P.L.; Stock Book, S.B.

Abbreviations for Various Books.

Petty Cash.

Before proceeding further, a few words must be devoted to *Till Money*, *Carmen's Change*, and *Petty Cash*. The first of these consists of a definite amount of money kept in the till or tills for change. When the takings are removed from the till each night, this sum is replaced to serve as change for the following morning. A smaller sum of money is usually given to each of the carmen for change. Every evening when the rounds have been finished, the carmen should pay in all the money in their possession on behalf of the business; and after the totals have been checked as described in connection with the Bread Ledger, that part of their cash which represents cash for change should be placed in a separate drawer in the till in readiness for the following morning. Thus, suppose there are six carmen kept, each being allowed half a crown for change; fifteen shillings in small change would be separated from the money paid in and placed in the till to be withdrawn next morning. *Petty Cash* consists of a definite sum of money set aside for the payment of small items which it is found necessary to purchase during the day. These disbursements are entered in the Expenses Book, as described later, and at the end of the day the total is ascertained. The balance should represent the petty cash in hand. Thus, if £5 is kept, and during one day £1, 9*s.* 2*d.* is taken for expenses, the balance £3, 10*s.* 10*d.* should be the total of the cash. Where a cash-registering till is kept, some bakers, in place of keeping separate petty cash, withdraw their expenses from the till, at the same time marking "cash withdrawn". The till automatically casts these up, and at the end of the day the total should agree with that of the Expenses Book. The petty cash can also be forgone if the till is of the paper roll type; the roll having two columns, the expenses are entered in one column, and the takings in the other. The total of both columns is found at the end of the day. That of the expenses should agree with the total of the items in the Expenses Book; that of the takings will be considered later. Confusion sometimes arises owing to the prevalence of the use of the farthing. Where the total of any of the takings or expenses amounts to an odd farthing, halfpenny, or three-farthings, it is advisable to leave this fraction in the till.

The eight books already referred to will now be described in detail in the order decided on above.

Expenses Book

This book is about 15 in. long by 5 in. wide. It is ruled with one cash column on the right-hand side of each page, and with a margin on the left-hand side. In it are entered the expenses, such as cream, milk, yeast, &c., as they occur during the day. Sums taken for private or household use must be entered along with the other expenses, and the total of the whole taken at the end of the day. Beside each payment is placed an abbreviation, showing under which head it is analysed in the Analysis Book. These headings and abbreviations are explained in the description of the latter book. The Expenses Book is generally kept in the shop and entered up by the assistants.

Contents of Expenses Book.

The following is an example of a page:—

DAILY EXPENSES

		£	s.	d.
	January 1st, 19...			
G.P.	Cream	0	2	1
X.	Directory	0	2	0
B.	Bags	0	5	0
X.	Gratuity	0	0	3
T.	Cake rings	0	10	6
W.	Commission	0	4	0
G.P.	Ice	0	1	6
"	Salt	0	0	10
A.	Advertising	0	3	0
		1	9	2
	2nd.	£	s.	d.
D.	Repairs to horse cloth	0	2	0
A/c Pd.	Leesin Bros. a/c	0	8	7
G.P.	Ice	0	1	2
"	Yeast	0	1	11
X.	Gratuity to flour carter	0	0	4
"	Gratuity to window cleaner	0	0	3
G.P.	Cream	0	1	2
W.	Commission	0	2	6
X.	Sweep	0	1	0
G.P.	Fruit	0	0	6
X.	Carriage	0	0	8
		1	0	1

Analysis Book or Analytical Journal

This book is of foolscap size, ruled with about a dozen cash columns across the double page. As may be gathered from its name, it contains an analysis of the expenses for each day as they have been placed in the Expenses Book. The words "Daily Expenses" are inserted at the head on the line provided, together with the month and year during which the expenses were incurred. Three or more lines

Headings for Analysis Book.

are ruled off, and at the top of each cash column is placed one of the headings under which it is desired to analyse the expenses. The most useful headings are:—

Heading.	Abbreviation for Use as explained above.
1. Private drawings	P.
2. Household and keep of assistants ...	House.
3. General purchases	G.P.
4. Wages	W.
5. Coals	C.
6. Bakehouse tools	T.
7. Bags, books, and stationery	B.
8. Accounts paid	A/c Pd.
9. Horse and delivery expenses	D.
10. Trade expenses	X.
11. Advertising	A.
12. Yeast	Y.
or Waiters' wages	W.W.
or Hire expenses	H. &c.

In the space at the left-hand side of the left-hand page must now be placed the name of the month and the dates of it under each other. It will be found well to leave a line or so between the weeks. Moreover, it is strongly advised to insert these headings and dates, together with the rulings for the totals, previous to the commencement of the month. Each day after the Expenses Book has been totalled, the items must be roughly analysed, thus:—

Rough Analysis of Expenses.

General Purchases.	Trade Expenses.	Bags, Books, and Stationery.
s. *d.*	*s.* *d.*	*s.* *d.*
2 1	2 0	5 0
1 6	0 3	
0 10	—	
4 5	2 3	

Bakehouse Tools.	Wages.	Advertising.
s. *d.*	*s.* *d.*	*s.* *d.*
10 6	4 0	3 0

Posting Analysis Book.

The totals, viz. 4*s.* 5*d.*, 2*s.* 3*d.*, &c., should be placed in the Analysis Book opposite the date on which they occur, and under their respective headings. Their total should be entered in the "total" column. This procedure is continued throughout the month, at the end of which the amount expended under each heading must be totalled, and the total of these must be identical with the sum of the totals for each day. Thus in the specimen given below:—

Checking Totals.

	£	s.	d.
Private drawings	9	0	0
Household and keep of assistants ...	10	9	6
General purchases	6	9	1
Wages	43	3	0
Coals	1	15	0
Bakehouse tools	1	15	0
Bags, books, and stationery	1	6	1
Credit accounts paid	1	10	1
Horse and delivery expenses	1	6	3
Trade expenses	3	7	10
Advertising	1	3	0
Sum of daily totals	81	4	10

These amounts should be now posted to their respective accounts in the Private Ledger, as explained later, the pages or folios of these being placed under their monthly totals in the Analysis Book. Where an account is paid for goods supplied on credit, and *in connection with which an account has been opened in the Ledger,* the name of the firm must be inserted in the column provided for that purpose, and the cash so paid should be posted to the account in the Ledger in the same way as the cash from the Cash Book (see later). Where discount is allowed on such a payment, it must be entered in the Cash Book along with the other discounts. It is, however, advisable that as few ledger accounts as possible be paid through the petty cash.

A specimen month of the Analysis Book will be found on pages 142–143.

Takings Book

This book is of the same size and contains the same rulings as the Expenses Book. It is generally kept in the shop and entered up by the shop assistants. The balance of cash in hand brought forward from the previous day, after deducting a definite amount for till money and petty cash, is counted, and the amount entered thus:—

		£	s.	d.
Dec. 31	Cash in hand..................	5	9	6

The takings in a baker's and confectioner's business may be conveniently divided into three divisions, viz.: customers' accounts paid; carmen, amount brought in; and shop takings. As regards their entry in the Takings Book, the date is placed at the top of the page; and then as each customer pays his account in the shop, the amount so paid is entered, and at the end of the day such sums are totalled. As each carman comes in, the amount that each has collected (the cash for change having been separated, as described above) is also entered, and the number of the round specified.

Entries in Takings Book.

Directly the shop is closed it will be necessary to determine the shop

takings for the day. The money in the till should be taken out, with the exception of the till money for change, and counted. The total should agree with the total registered by the till or of the items on the till roll. If the carmen's money, *i.e.* their receipts, not their change, has been paid into the till, the total of these, together with that of the customers' accounts paid, will have to be deducted before the shop takings are obtained. Thus, suppose £10, 3*s.* 6*d.* is found in the till, the customers' accounts paid being £3, 2*s.* 7*d.*, and the amount brought in by the carmen £2, 11*s.* 3*d.*, the shop takings will be £10, 3*s.* 6*d.* less £5, 13*s.* 10*d.*, *i.e.* £4, 9*s.* 8*d.* From the petty cash £1, 9*s.* 2*d.* has been paid. This must be made up from the £10, 3*s.* 6*d.*, leaving £8, 14*s.* 4*d* to be put in the safe with the £5, 9*s.* 6*d.* from the previous day ready for banking.

Determining the Day's Takings.

The following are two typical pages:—

TAKINGS BOOK

	£	s.	d.
DECEMBER 31ST, 19...			
Cash in hand............	5	9	6
JANUARY 1ST, 19...			
Customers' Accounts paid—	£	s.	d.
Jos. Jackson............	0	3	6
R. Smithson............	0	10	7
John Rice............	1	0	4
Jacob Jones............	0	5	1
R. Roberts............	0	12	0
Mrs. Richard............	0	4	3
Mrs. Steep............	0	5	9
C. Banes............	0	1	1
	3	2	7
Carmen—			
1st Round £0 17 11			
2nd " 1 0 9			
3rd " 0 12 7	2	11	3
Shop Takings............	4	9	8
	10	3	6
Less Expenses as per Expenses Book.......	1	9	2
	8	14	4
Add Cash in hand brought forward......	5	9	6
	14	3	10
Less paid into Bank (*nil*)............	0	0	0
Carried forward...	14	3	10

TAKINGS BOOK

	£	s.	d.
JANUARY 2ND, 19...			
Customers' Accounts paid—	£	s.	d.
Mrs. Blythe............	0	2	7½
"Newstead"............	0	15	4
26 Redtin Rd............	0	4	8½
Mrs. Ewert............	0	7	6
Miss Jones............	0	3	11
E. Newcome............	0	2	9
The Bull............	0	14	11
	2	11	9
Carmen—			
1st Round £0 19 3			
2nd " 1 3 9			
3rd " 0 17 2	3	0	2
Shop Takings	5	7	11
	10	19	10
Less Expenses as per Expenses Book........	1	0	1
	9	19	9
Add Cash in hand brought forward......	14	3	10
	24	3	7
Less paid into Bank....	14	5	8
Carried forward...	9	17	11

Cash Book

The Cash Book is, like the Analysis Book, of foolscap size. On the debit or left-hand side are six cash columns, to the left of which is a

column for the month and date. On the credit or right-hand page there are three cash columns to the extreme right, next to which is a folio column. A small margin and column bears the month and date, while the next column shows to whom the cheques are paid, and the following one what the cheques are for.

The columns are headed respectively, reading from left to right:—

Debit Page

Entries as Debits in Cash Book.

Customers' accounts paid.
Carmen: amount brought in.
Shop takings.
Total.
Expenses.
Banked.

Credit Page

Entries as Credits in Cash Book.

Cheques drawn in favour of.
What for?
Folio.
Discount.
Amount of cheque.
Monthly totals.

The month and dates are entered on the debit page before the commencement of the month in the column provided for that purpose.

From the above headings the book is seen to contain on the debit side summarized records of (1) the Takings Book, (2) the Expenses Book, and (3) the amounts paid into the bank; while on the credit side are (1) the amounts of the cheques drawn out of the bank, (2) discount, &c. A summary is made at the end of every three months for balancing the cash and recording such transactions as are neither takings nor expenses.

Nature of Entries as Takings.

Takings must be strictly limited to money received for goods that have been sold in trading as a baker and confectioner. The sale of a horse would not be included with the takings, but would be entered separately in the Takings Book, thus:—

	£	s.	d.
Customers' accounts paid	4	5	10
Carmen: amount brought in	5	8	1
Shop takings	6	17	4
	16	11	3
Less expenses	13	6	6
	3	4	9
Amount brought forward	20	11	7
	23	16	4
Sale of horse	15	15	0
	39	11	4
Less banked	20	3	0
Forward to next day	19	8	4

Moreover, when the amounts of the customers' accounts paid, &c., are entered in the Cash Book, the amount of any such sale must be entered in the summary. The significance of this will be understood later.

The subdivision of the takings, which has been arrived at in the Takings Book, is now utilized to show the class of business carried on: that is, whether the bulk of the customers run weekly or monthly accounts, whether the rounds are the valuable part of the concern, or whether the shop itself is the cream of the business. The totals of the money received under the three divisions—viz., customers' accounts paid: carmen, amount brought in; and shop takings—should be entered under their respective headings and opposite the date on which they are received. The total of these three amounts is inserted in the "total" column, and that of the expenses in its column. When money is paid to the bank, the amount must be noted in the "banked" column.

Kind of Business Done.

As each cheque is drawn it must be entered on the credit side, together with the discount, if any, allowed. It will be found very useful on entering each cheque to note in the "what for?" column for what goods or expenses such cheque has been drawn. At the end of the month the total of all the cheques drawn should be inserted in the "monthly totals" column, and the totals of both this and the "cheques" column must be carried forward to the next page. The discounts should be totalled, and the sum entered in the discount account in the Private Ledger, to be described later.

On the debit side the monthly totals of the analysed takings should agree exactly with the sum of the "total" column, thus:—

Detail and Gross Totals Check.

	£	s.	d.
Customers' accounts paid	81	6	3
Carmen: amount brought in ...	89	10	7
Shop takings	133	3	7
Sum of "total" column ...	304	0	5

The expenses should be totalled, and the amount should agree with the sum of the "total" column of the Analysis Book.

When the books are started, and at the beginning of every three months, the balance of cash at the bank should be placed at the head of the "banked" column on the first page of the next quarter. If the balance is overdrawn, it should be placed in the "cheques" column on the credit side of the book. The total of the former balance, together with the amounts banked, should be found and carried forward to the next month; while if the balance is overdrawn, it should be included in the total of the cheques carried forward to the next month.

Cash and Debit Balances.

A specimen month of the Cash Book is shown on pages 140–141.

The takings, expenses, bankings, and cheques for the next two months must be entered up in precisely the same manner as described above. But at the close of the three or six months a quarterly or half-yearly cash

summary account must be made on the fourth or seventh page of the Cash Book. Similar summaries must also be made at the end of every succeeding quarter or half year, and will be entered on every fourth or seventh page. It is inadvisable to make these summaries less frequent than half a year.

The summary is best headed:

Dr. Summary of cash for the three months ending.........*Cr.*

On the debit page is first placed the balance of cash in hand at the commencement of the quarter; or if it is the first quarter, the cash in hand on the day on which the books were started. The latter, it will be remembered, was entered in the commencement of the Takings Book, while the former will be identical with the final balance in the previous summary. Under this balance is placed the amount of the till money, thus:—

		£	s.	d.	£	s.	d.
Dec. 31	To Cash in hand..................	5	9	6			
" "	" Cash—Till Money............	2	0	0			
		—	—	—	7	9	6

The total of these is run out into the next cash column, as above.

Entries must now be made of all the cash which has come into the business. In many cases these will be solely the totals of the takings from the three previous pages of the Cash Book. If this is so, the amounts must be debited, and then the total run out to the next cash column, thus:—

		C.B.	£	s.	d.	£	s.	d.
Jan.	To Takings	1	304	0	5			
Feb.	" "	2	296	14	3			
Mar.	" "	3	318	1	6			
			—	—	—	918	16	2

If money was received for the sale of a horse or van, or from a similar source, the amount must be placed under the takings, thus:—

		P.L.	£	s.	d.
Mar. 5	To Sale of Horse.........	93	15	15	0

Such an entry as the above must be posted to the credit side of the horse stock account in the Private Ledger.

This will conclude the items on the debit side. On the credit side there must be placed all the cash which has been paid away. Now, part of this will have gone in payment of expenses, and part of it banked. The monthly amounts which have changed hands under these two heads must be entered, thus:—

		A.B.	£	s.	d.	£	s.	d.
Jan.	By Expenses	1	81	4	10			
Feb.	" "	2	76	3	8			
Mar.	" "	3	78	1	2			
						235	9	8

		C.B.	£	s.	d.	£	s.	d.
Jan.	By Amount paid to Bank	1	216	15	3			
Feb.	" " " "	2	221	9	0			
Mar.	" " " "	3	234	17	6			
						673	1	9

It should be noted that the amount banked any month is best obtained by subtracting from the amount of the "banked" column at the end of the month the total of the same brought forward at the beginning of the month, thus:—

Bank Account in Summary.

	£	s.	d.
Total at the end of July	288	18	9
Commencing balance	72	3	6
Amount banked	216	15	3

These being entered, any other expenses which have been paid, *but have not been placed in the Analysis Book*, such as the payment of repairs, &c., must be credited.

Detecting an Error.

The difference between the total of the debit page and the total of the expenses, amounts banked, and any other expenses, should be identical with the sum of the cash in hand on the last day, as shown by the Takings Book and the till money. If this is so, this balance and till money should be filled in and the two sides totalled as in the specimen below. If, however, this is not the case, either an error must have been made in the bookkeeping, or else some receipt or payment has been made and not recorded.

The table on p. 128 is a sample quarterly cash summary account, supposing that nothing has been received or paid outside the ordinary business routine.

Receipts and Payments in Connection with the Private Estate.

Although departing from the allotted course, in order to save a large amount of repetition, a few words will be here devoted to receipts and payments in connection with the private estate. This may consist of house property, debentures in limited companies, mortgages, &c. The receipts, rent, interest, &c., must all be entered first in the Takings Book on the day on which they are received, and entered from there direct to the Cash Book summary, just as in the case of money received for a horse, &c., sold. Every payment made in ready cash from the till or till money, in connection with the private estate, must be entered in the Expenses Book on

SUMMARY OF CASH FOR THE THREE MONTHS ENDING MARCH 31ST, 19...

4 *Dr.*

			£	s.	d.	£	s.	d.
Dec. 31	To Cash in hand	P.L. 195	5	9	6			
" "	" Cash—Till Money......		2	0	0			
" "	" Cash—Petty Cash for Expenses		5	0	0	12	9	6
Jan. —	To Takings...................	C.B. 1	304	0	5			
Feb. —	" "	C.B. 2	296	14	3			
Mar. —	" "	C.B. 3	318	1	6	918	16	2
						931	5	8

Cr. 4

			£	s.	d.	£	s.	d.
Jan. —	By Expenses..................	A.J. 1	81	4	10			
Feb. —	" "	2	76	3	8			
Mar. —	" "	3	78	1	2	235	9	8
Jan. —	By Amount paid to Bank	C.B. 1	216	15	3			
Feb. —	" " " "	2	221	9	0			
Mar. —	" " " "	3	234	17	6	673	1	9
Mar. 31	By Cash in hand...........	C.B. 8	15	14	3			
" "	" Cash—Till Money.....	"	2	0	0			
" "	" " —Petty Cash for Expenses..............	"	5	0	0	22	14	3
						931	5	8

the day on which it was paid, but separated from the ordinary business expenses, thus:—

April 12th.

	£	s.	d.
a. Private drawing	1	0	0
b. General purchases	0	4	3
c. Horse and delivery expenses	0	2	0
d. Trade expenses	0	3	4
	1	9	7
Paid for repairs to 7 Parker Street ...	3	5	0
	4	14	7

Great care should be taken to put the amounts *a*, *b*, *c*, and *d* in the Analysis Book, together with their total, £1, 9*s.* 7*d.* The repairs, on the other hand, should, as explained above, be at once credited to the cash summary account. At the end of the quarter the summary is closed in the same manner as explained earlier.

Quarterly Balance of Cash at Bank.

In addition to the quarterly balance of the petty cash, the cash at the bank must also be balanced quarterly with the bankers' pass book. This is effected by totalling the amounts paid into the bank with the amount brought forward from the previous month, and totalling the amounts of the cheques paid during the third month with the previous month's total. The excess of the former over the latter will give the balance of the cash at bank, or the reverse will give the balance overdrawn. This should agree exactly with that shown in the bankers' pass book, provided that all the cheques have been "cleared". If the cheques or payments to the bank are entered *after* the end of the quarter in the pass book, they have not been cleared, and must be added to the credit and debit totals of the pass book respectively, and the same balance obtained, thus:—

	£	s.	d.		£	s.	d.
To Amount Banked.......	745	5	3	By Amount of Cheques	686	17	7
				" Balance	58	7	8
	745	5	3		745	5	3

As per Pass Book

	£	s.	d.		£	s.	d.
Dr. Total	1313	17	8	*Cr.* Total	1273	12	6
Not Cleared........	32	6	0	Not Cleared......	12	1	10
					2	1	8
				Balance...............	58	7	8
	1346	3	8		1346	3	8

Checking Cash Book by Bank Book.

The balance so obtained must be carried forward to the commencement of the first month of the next quarter. If the balance of the Cash Book cannot be got to tally with the bankers' pass book, it is probable that a cheque has been erroneously entered.

Journal or Day Book

Function of Journal.

The Journal or Day Book is essentially a complete record of the goods purchased on credit. It generally consists of a book of foolscap size, having two cash columns and a folio column separated from a date column by the requisite space for copying the invoices. As each invoice arrives and the goods are checked, it is given the next number to the last already entered, and is copied in either in detail or briefly. In the case of millers' carmen's notes, where the amount is not known, the entry is best made as follows:—

July 10. John Stokes, 50 sacks whites,

Pricing Flour Consignments.

and the amount filled in either when the invoice comes to hand a few days later, or when the miller's book is entered up by the traveller. If, however, the flour (or other goods) is being supplied at an agreed price, or under contract, the amount will be known, and can be at once filled in. After each invoice has been entered and numbered, it is placed upon a file, preferably one which opens as a book. It is left there until the end of the business year, when it will be found convenient to empty the files and store them in packets. When credit notes are received for goods returned or allowances made, the name of the firm with the amount and particulars should be entered in *red ink.* The money should not, however, be run out into the second cash column, but left in the first, so that when the columns are totalled the credits are not confused with the debits. Where paper bags, customers' books, coals, and forage are bought on credit, or expenses incurred for hire, they should be entered up in precisely the same manner as the flour and general purchases. It is also a good plan to enter in the Journal the accounts as they are rendered for rent, rates and taxes, gas, electric light, and water. These should be entered up in the same manner as the invoices. Many business men, however, prefer to keep these expenses out of the Journal, and to enter them straight into their respective accounts in the Private Ledger. If desired, this may be done.

Filing Invoices.

Credit Note Entries.

Rent, Rates, Gas, &c.

Specimen entries will be found on pages 144–145.

Analysis of Invoices.

Quarterly or half-yearly the Journal should be totalled, the total of each page being carried forward to the top of the next, and so on. When this has been done, the invoices will have to be carefully analysed; but, as any error in the invoices will at once throw the analysis out, it will always be found advisable to do the analysis *after* the auditor has checked the invoices and additions, or to leave it for his consideration. The headings for this analysis which have been found most useful are:—1. Flour; 2. General purchases, including such items as butter, eggs, &c.—all things, in fact, that are part of the goods sold in the business of a baker and confectioner; 3. Bags, books, and stationery; 4. Coals; 5. Forage; 6. Hire expenses; and (if required)

7. Rent; 8. Rates and taxes; 9. Gas; 10. Electric light; and 11. Water, &c. If no horses are used (5) will be unnecessary. The total of the purchases and expenses under each of these headings is obtained, and the sum of these should be identical with the sum of the amounts of the invoices, thus:—

SUMMARY OF PURCHASES

FOR THE THREE MONTHS ENDING 31ST MARCH, 19...

	P.L.	£	s.	d.
Flour	34	398	17	3
General Purchases	56	201	8	5
Bags, Books, and Stationery	105	4	12	0
Coals	99	1	15	0
Forage	111	5	14	3
Hire Expenses	125	3	12	6
Rent of Shop	65	24	0	0
Rent of Stables	65	3	10	0
Rates and Taxes	71	8	14	11
Gas	83	8	19	4
Electric Light	89	5	2	2
Water	95	3	3	0
Van and Cart Repairs	132	12	10	0
Bakehouse Tools	136	5	0	0
Trade Expenses	116	3	5	9
Advertising	121	2	15	0
Total of Invoices		692	19	7

The credit notes should also be analysed under these headings and the sum obtained.

SUMMARY OF RETURNS

FOR THE THREE MONTHS ENDING 31ST MARCH, 19...

	P.L.	£	s.	d.
Flour	34	5	10	0
General Purchases	56	8	5	7
		13	15	7

These summaries should be entered as above in the Journal at the end of the period. The amounts of the purchases and expenses incurred under the enumerated divisions should be placed to the debit of the corresponding accounts in the Private Ledger.

In no case should the entries in the Journal be crowded together, as this at once encourages mistakes. In cases where an item is found to have been omitted, it is best to place it in with the invoices of the current month, noting in brackets its actual date.

LEDGER

In the Ledger are kept the accounts of all the persons and firms from whom goods are bought on credit. If the expenses, such as rent, rates and taxes, &c., are entered up in the Journal, accounts must be opened for the persons or firms in connection with whom

Purpose of the Ledger.

these expenses are incurred. When buying Ledgers, it is always advisable to get one having both the debit and credit sides on the one page—or in other words, paged, not folioed. The old-fashioned folioed Ledger is far more irksome to use than the more modern paged one.

Opening Ledger Accounts.

At the time when the books are opened, a page in the Ledger must be allotted to each of the creditors, and the balance due entered on the first or second line on the credit or right-hand side. On the space provided above it is well to put not only the name of the person or firm from whom the goods are obtained, but also their address, and a note of the discount allowed at settlement. This in actual practice is found most useful. The balances being thus entered, and the accounts recorded in the index, the next consideration is the entering or posting, as it is called, of the goods and expenses from the Journal. The account of the firm from whom the goods noted in the first invoice were obtained is turned up in the Ledger, and under the balance, which we will suppose already there, an entry is made thus:—

Source of Items for Ledger.

			£	s.	d.
		P.L.			
Dec. 31	By Balance	195	2	15	7
		J.			
Jan. 3	" Goods	1	7	14	8

The total of the invoice is alone inserted. If no balance was owing to the firm in question on the day on which the books were started, no account will have been opened for them. This must now be done, and the entry made as already stated. In opening fresh accounts it is essential that the name of the firm, with the page or folio of their account, should be entered in the index. If this is not done, a great deal of trouble will be occasioned by not being able to find any desired account, and may lead to two accounts being opened for one firm. The remaining invoices are posted to their respective accounts in like fashion. Attention must now be turned to the debit or left-hand side of the account. Here are posted the credit notes, which have been entered in red ink in the Journal, thus:—

Dr. Sips & Co., 7 Strand, W.C. *Cr.* 173

		J.	£	s.	d.			P.L.	£	s.	d.
Jan. 15	To Returns......	4	1	16	4	Dec. 31	By Balance due	195	22	3	6
" 29	" "	7	2	5	6			J.			
						Jan. 8	" Goods.........	2	5	3	7
						" 10	" "	3	2	9	4
						" 19	" "	5	1	3	6
						" 26	" "	6	4	19	10

Allowances on eggs, &c., should be entered in the same manner as returns.

Having concluded the posting of the goods and returns from the Journal, it may now be supposed that the time has arrived when some of the accounts are paid, some discount being allowed. Opening the Cash Book, already described, the account of the firm to whom the first cheque was paid is found, and the cheque entered in the Ledger, thus:—

Entering Payments.

		C.B.	£	s.	d.
Jan. 2	To Cash	2	32	10	0
" "	" Discount................	"	0	12	6

The discount, if any, is entered underneath the cash, as shown above.

In all probability the cash, together with the discount, returns, and allowances (if any), will settle the account up to a certain date. The two sides of the account should then be added, and the totals should agree, thus:—

Balancing an Account.

Discount: 2½ % in a Month.

Dr. ROBERTS & CO., 8 STRAIGHT STREET, E.C. Cr

		J.	£	s.	d.			P.L.	£	s.	d.
Jan. 8	To Returns......	3	1	3	2	Dec. 31	By Balance......	195	13	4	6
		C.B.						J.			
" 10	" Cash..........	1	17	15	9	Jan. 2	" Goods.......	2	5	0	5
" "	" Discount.....	"	0	9	2	" 6	" "	4	1	3	2
			19	8	1				19	8	1

If the two sides do not agree, it is probable that either the invoices have not been posted correctly, or the cash includes an item entered in the next month or excludes the last item noted.

When accounts are being paid, it will be found most convenient to check the statement with the Ledger account. In this way discrepancies are not passed over.

In the accounts of the gas company for gas supplied, of newspapers for advertising, &c., the amount of the debt incurred for such is noted just as in the case of goods, while the cash is also similarly entered, thus:—

Dr. THE REDSTERE GAS COMPANY, 7 ELM STREET, REDSTERE Cr. 102

		C.B.	£	s.	d.			P.L.	£	s.	d.
Feb. 5	To Cash....	2	8	2	5	Dec. 31	By Balance due.....	195	8	2	5
								J.			
May 10	" Cash....	5	8	19	4	Mar. 31	" 1 Quarter's Gas	30	8	19	4

Private Ledger

The Private Ledger contains accounts which are of a confidential nature, such as capital, profit and loss accounts, loans, premises accounts, &c. It also contains impersonal accounts, such as flour, general purchases, wages, rent, rates and taxes, gas, &c.

Dual Purpose of Ledger.

Some business men prefer to do away with this book, and to divide the Ledger into two sections, one doing the work of the Ledger as already described, and the other half acting as a Private Ledger and containing all the accounts now to be described.

Assets and Liabilities

Let us suppose that a baker and confectioner has decided to start this system of bookkeeping on a certain day, and has provided himself with the necessary books. The first business to be done when the all-important day arrives is to determine his assets and liabilities.

The former of these may briefly be summed under the following heads:—

Valuing Assets.

1. Cash at bankers'.
2. Cash in hand.
3. Till money and petty cash.
4. Flour stock.
5. General purchases stock.
6. Bags, books, and stationery stock.
7. Coals stock.
8. Horse stock.
9. Forage stock.
10. Vans, carts, and harness stock, including barrows and stable tools.
11. Shop fittings and sundries.
12. Bakehouse tools and utensils-in-trade stock.
13. Goodwill.
14. Other assets.
15. Book debts.

1. *Cash at Bankers'.*—This is entered on the first page of the Cash Book as already described. If no cash account has been previously kept, it can be obtained from the bankers' pass book.

2. *Cash in Hand,* and 3. *Till Money and Petty Cash.*—These are found as described in the Takings Book, and are entered as the starting balance of the first quarterly cash summary account.

4. *Flour Stock.*—This is ascertained by counting the sacks unused and knowing their cost, working out the value of the whole, as well as the value of flour in sacks which may have been opened. A specimen of this is given later on, in connection with the Stock Book.

5. *General Purchases Stock.*—This may be divided into two classes, viz. bakehouse and shop. The former includes butter, eggs, &c., and, in

fact, all things except flour, which are part of the goods sold; while the latter consists of the cakes, &c., in stock, ready for sale, and also such goods, which are not made on the premises, as chocolates, sweets, biscuits, tea, &c. All these things are taken down in detail, the weights and prices apportioned, and their value determined. The detail is entered as described in the Stock Book, while the total is placed here amongst the assets.

6. *Bags, Books, and Stationery Stock.*—This stock ought to be most accurately calculated. It is far more satisfactory to count the packets of bags, books, &c., and ascertain their total cost, instead of placing the value of the whole at a round sum. All kinds and sizes of bags, customers' books, and any other books and stationery which will, in course of time, be used in the business, should be included in this stock. As with the stocks above, the detail should be entered in the Stock Book.

7. *Coal Stock.*—Very little requires to be said about this stock; it is not a difficult matter to decide whether it consists of one, two, or more tons. And since the price paid is known, the total cost is soon found.

8. *Horse Stock.*—The valuation of this stock presents more difficulty. It should be based upon two considerations, viz.: (1) the age of the horses and their present capability for work, and (2) their price when bought. As so much depends on these details, more cannot be said. The detail should be entered in the Stock Book.

9. *Forage Stock.*—This consists of corn, chaff, &c., and is found by following the lines set out in connection with the general purchases stock. The sundry items should be entered, priced, valued, and totalled in the Stock Book.

10. *Vans, Carts, and Harness Stock, including Barrows and Stable Tools.*—The value of the vans, carts, &c., comprising this stock depends largely on their cost and present condition. The harness and stable tools may be entered as a different stock from the vans, carts, and barrows, but it is advisable not to have too many subdivisions. As before, record should be made of this stock in the Stock Book.

11. *Shop Fixtures, Fittings, and Sundries.*—The value of the shop fixtures and fittings is adjudged by their estimated value when the business was bought, or their actual cost if put in at the owner's expense. In both cases the number of years these have been fitted must necessarily be brought into consideration. The shop sundries, such as chairs, glass stands, &c., should be priced out in the same manner as the general purchases, and may, if desired, be regarded as a separate stock from the fixtures and fittings.

12. *Bakehouse Tools and Utensils-in-Trade Stock.*—Under this category are included the troughs, bins, and all the ordinary bakehouse utensils. After these have been valued according to their cost prices, a certain amount should be deducted for deterioration. This would, of course, vary with the number of years the articles had been in use.

13. *Goodwill.*—The goodwill of a baker's business consists of its real value over and above that which is actually convertible and can be

realized. It consists of two parts: the goodwill of the rounds on the one hand, and that of the shop on the other.

It is usual, on the purchase of a business, to include in the purchase price such items as the lease, shop fixtures and fittings, tools and utensils in trade, horses, vans, carts, &c.; hire stock, improvements to buildings, &c. After the actual value of these has been ascertained, the owner is in a position to know what he has paid for the goodwill. The value of the goodwill depends principally on the price received for the bread; whether the rounds are easily worked and not unnecessarily extended. Moreover, it is greatly influenced by the style of the neighbourhood, the position of the shop—main road or otherwise—and the class of people served. In fact, so much depends upon these particular details that it is quite impossible to enter into a lengthy article on the subject.

What Determines Value of Goodwill.

14. *Other Assets.*—It is generally the case that a business has other assets besides the aforementioned. Thus, if shop and premises are owned or held under a lease by the baker and confectioner, these should undoubtedly be included and described as *freehold or leasehold premises.* Again, if extensive repairs or alterations have been made, such as the fitting of a refreshment room or the building of new ovens, these improvements will extend over a number of years, and therefore a proportionate amount should be included in the assets.

Valuing Premises and Alterations.

Where catering is done there will also be some *hire stock*, probably consisting of silver-plated goods, china, glass, tables, chairs, rout seats, &c. These should be counted and carefully priced out, taking into consideration their condition at the time of pricing. The detail should be entered in the Stock Book.

15. *Book Debts.*—This, the last asset which has to be considered, is usually already kept in the Bread Ledger, and the amount is obtained by merely totalling them on the desired day.

Near the end of the Private Ledger an account must be opened for the balance sheet, of which the above are the assets. The date must be inserted, along with the words "Balance Sheet". On the credit is written the word "Assets", and on the debit "Capital and Liabilities". The assets, which have been obtained above, must be entered on the credit side under the word "Assets". This being done, it will be now necessary to find the capital and liabilities by which these assets are balanced. To the latter of these attention will first be given.

The bulk of the liabilities will naturally be to the wholesale houses for goods supplied, and probably also a few for the expenses already mentioned, such as rent, rates, &c. On the day on which it is desired to start the books, the statements showing the exact liability to each firm should be collected, and the whole of them, not simply the total, entered on the debit side of the balance sheet mentioned above. These balances are now entered in the Ledger as described above, and the number of the page on which each is credited is

Liabilities.

inserted in the column provided for that purpose in the balance sheet, thus:—

	L.	£	s.	d.	£	s.	d.
Jackson & Co.	1	17	4	3			
Pit Flour Co., Ltd.........	3	46	7	0			

The page of the Private Ledger on which the balance sheet is placed should be entered in the Ledger with each of the balances, thus:—

Dr. DRAYTON & CO., 39 FOULEY STREET, E.C. *Cr.*

								P.L.	£	s.	d.
						July 1	By Balance	195	18	16	0

It is well to enter the creditors in an inner column ruled for that purpose in the balance sheet, and to run their total out to the main column.

It being assumed that all the creditors are entered, attention must be given to the other liabilities. These may include money which has been borrowed for the purchase of the business, or part of the purchase price which has not yet been paid, together with the accrued interest on the same. If the first of these is the case, the name of person from whom the money was obtained, together with the amount, should be placed above the list of trade creditors already described, thus:—

Purchase Money on Loan.

	P.L.	£	s.	d.
To C. Honk Loan A/c.......................	3	300	0	0
" Interest accrued on same—less Tax		8	11	0

If the money is lent in the form of a mortgage, the word "mortgage" should be substituted for "loan".

If some of the purchase money is unpaid, a similar account to the above should be opened, but should be headed only with the name, "K. Morris", and entered, "By balance of purchase money due". All such liabilities must be entered along with the loan described in the balance sheet.

The two sides of the balance sheet are now totalled, and the excess of the assets side over the liabilities will represent the capital in the business on that particular day.

If the business is owned by several partners the capital will have to be divided. In this case a capital account must be opened for each of the partners, and must bear their names, thus:—

L. Riddle, Capital Account.

The opening Balance Sheet, including the above balances, is not shown, as a specimen Balance Sheet is given on p. 155. The balances will, however, be found in their respective accounts in the detailed transactions given later.

Accountant's Certificate.

In many cases items for the balance sheet will crop up which cannot be dealt with in the foregoing manner. If this is so, the only remedy is to seek the advice of a professional accountant. Moreover, if the balance sheet is certified correct by a disinterested professional accountant it carries far more weight than if simply prepared by the owner of the business.

A slight deviation will now be made in order to introduce

The Stock Book

The use to which this book is applied has already been anticipated. It records the details of the various stocks on each of the days when the books were closed.

The stocks which should be entered are:—1. Flour stock; 2. General purchases stock; 3. Bags, books, and stationery stock; 4. Coals stock; 5. Horse stock; 6. Forage stock; 7. Vans, carts, and harness stock; 8. Bakehouse tools and utensils-in-trade stock; 9. Hire stock. If desired the shop sundries may be entered.

The pages are of foolscap size, and each is ruled for the stocks on two dates. In the first column the description is placed, while in the second and third are placed the quantity and price respectively, and in the last—a cash column—the value of each item is run out. An ample number of pages should be left between each two stocks to allow for the stock on future occasions.

It is difficult to obtain a book ruled as in the specimen below; but a plain book can be obtained and the pages ruled as required.

FLOUR STOCK

30th June, 19...

Description.	Quantity.	Price.	Amount. £	s.	d.
"Dewdrop" Flour	Sacks. 15	26/6	19	17	6
"Queen's" "	12	25/3	15	3	0
Stone "	Bags. 26	13/	16	18	0
Wholemeal "	Sacks. 4	23/	4	12	0
Rye "	3	23/6	3	10	6
Flour in Bins, &c.	Bags. 3	13/	1	19	0
Cones	—	—	2	10	0
		P.L. 10	64	10	0

31st July, 19...

Description.	Quantity.	Price.	Amount. £	s.	d.
"Milsee" Flour...	Bags. 27	13/9	18	11	3
"Dewdrop" " ...	24	13/6	16	4	0
"Queen's" " ...	10	14/	7	0	0
Stone " ...	12	13/9	8	5	0
Wholemeal " ...	6	13/9	4	2	6
Rye " ...	4	13/	2	12	0
Flour in Bins, &c.	1½	13/6	1	0	3
Cones................	—	—	1	10	0
		P.L. 10	59	5	0

A Month's Transactions

The impersonal accounts will be best understood from a study of their use in a particular case. It will therefore be well to assume that a baker opens the necessary books on 30th June, and, after keeping them in the manner described for the month of July, wishes to close them on the 31st. In order to ascertain his profit or loss for the month he must take stock again on the 31st July. This he does, and enters the detail in the Stock Book as already described. Stocktaking is one of those necessary duties that are not always undertaken with the care desirable, yet in the case of goods of an expensive kind carelessness or a slipshod and inexact method may readily cause a balance to appear considerably under or considerably over what it should be. If the business is a mixed one there may be a great many articles to count or weigh, but if the advice given in a previous chapter is carefully followed, the store kept in good order, only one package broken at a time, and the broken packages actually weighed and not guessed at, then the work need not be very burdensome. The whole of the entries in his books for the month—with the exception of those in the Takings and Expenses Books, for which adequate examples have been given, and which are very easily understood—will be shown, and from them his profit and loss account and final balance sheet compiled.

The Summary of Cash for the month of July, which is placed on this page for convenience, should be read after the example of the Cash Book given on pages 140–141.

Summary of Cash for the Month of July, 19...

Dr.

				£	s.	d.
June 30	To Cash in hand	£4 8 3	P.L. 28			
" "	" Cash—Till Money	2 0 0	"			
" "	" Cash—Petty Cash for Expenses	5 0 0	"	11	8	3
July 31	" Takings		C.B. 1	601	9	9
" "	" Cheque returned—afterwards paid...		"	2	0	0
				614	18	0

Cr.

				£	s.	d.
July 31	By Expenses		C.B. 1 and A.B. 1	146	17	7
" "	" Amount Banked		C.B. 1	452	19	5
" "	" Cash in hand	£8 1 0				
" "	" Cash—Till Money	2 0 0				
" "	" Cash—Petty Cash for Expenses	5 0 0	carried to next Summary	15	1	0
				614	18	0

CASH BOOK

1 *Dr.* CASH

Date.	Customers' Accounts Paid.			Carmen: Amt. Brought in.			Shop Takings.			Total.			Expenses.			Banked.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
							To Balance at Bank...						P.L. 28			23	4	9
July 1	7	6	10	6	5	8	5	2	6	18	15	0	2	4	0			
" 2	6	3	1	7	3	2	6	13	10	20	0	1	3	17	11			
" 3	12	4	2	8	1	1	7	12	8	27	17	11	14	18	8	37	1	5
" 5	8	13	0	8	12	4	6	11	2	23	16	6	2	2	5			
" 6	6	0	2	6	4	2	6	10	0	18	14	4	5	4	8			
" 7	7	3	5	7	3	8	5	17	5	20	4	6	4	19	0	48	3	0
" 8	7	14	3	7	12	0	6	0	3	21	6	6	1	16	8	2	0	0
" 9	9	8	6	6	14	2	6	2	1	22	4	9	1	17	0			
" 10	13	4	2	7	0	3	6	13	4	26	17	9	16	7	0	55	3	1
" 12	9	12	4	8	2	7	5	13	8	23	8	7	4	12	3			
" 13	7	4	3	6	14	10	5	19	2	19	18	3	1	18	10			
" 14	6	17	10	7	3	5	6	3	7	20	4	10	5	15	7	47	6	6
" 15	7	8	9	7	12	1	6	0	6	21	1	4	2	16	2			
" 16	8	5	0	6	2	9	6	1	9	20	9	6	2	1	2			
" 17	14	0	4	7	16	3	8	10	5	30	7	0	15	15	6	51	2	9
" 19	9	2	6	7	5	6	5	11	2	21	19	2	1	14	1			
" 20	5	15	0	6	12	5	5	19	8	18	7	1	1	8	7			
" 21	8	19	3	7	3	1	6	12	5	22	14	9	1	2	7	51	15	1
" 22	7	18	6	7	14	0	5	15	0	21	7	6	3	11	0			
" 23	9	9	8	6	2	4	7	8	6	23	0	6	5	16	7			
" 24	12	4	10	8	5	3	6	10	0	27	0	1	15	5	5	56	12	7
" 26	8	15	2	6	12	3	5	6	3	20	13	8	1	14	3			
" 27	6	12	0	7	4	2	5	8	6	19	4	8	3	2	7			
" 28	9	2	4	6	8	11	6	0	9	21	12	0	2	11	5	46	16	2
" 29	8	7	6	6	19	10	5	19	10	21	7	2	2	7	4			
" 30	9	0	5	6	2	5	5	1	2	20	4	0	1	5	7			
" 31	13	10	3	7	12	7	7	9	6	28	12	4	20	11	4	56	18	10
	240	3	6	192	11	2	168	15	1	601	9	9	146	17	7	476	4	2
	P.L. 26			P.L. 26			P.L. 26			C.B. 2			A.B. 1					

CASH BOOK

CONTRA *Cr.* 1

Date.	Cheques Drawn in Favour of:—	What for:—	Folio.	Discount. £	s.	d.	Amount of Cheque. £	s.	d.	Monthly Totals. £	s.	d.
July 3	By Pit Flour Co., Ltd.	Flour	L. 3	0	17	0	45	10	0			
" "	" Cheque returned....	—	C.B. 2				2	0	0			
" 7	" Ripper & Kye, Ltd.	Flour	L. 4				50	0	0			
" "	" Self....................	Private	P.L. 2				6	0	0			
" "	" C. Honks..............	Interest	P.L. 3				8	11	0			
" 10	" Pit Flour Co., Ltd.	Flour	L. 3	1	6	0	69	7	6			
" "	" Jackson & Co.	G.P.	L. 1	0	8	7	16	15	8			
" 12	" Pershaw, Smith, & Co.......	G.P.	L. 2	0	0	9						
" "	" K. Jenkins...........	Insurance	P.L. 16				1	3	6			
" 14	" Ripper & Kye, Ltd.	Flour	L. 4				50	0	0			
" "	" Sewell & Snap.......	G.P.	L. 5	0	6	1	23	19	6			
" "	" Davis & Porter.. ...	Van reprs.	P.L. 5				3	14	6			
" "	" R. Jones..............	Rent	P.L. 14				27	10	0			
" 19	" Jackson & Co.	G.P.	L. 1	0	6	7	12	16	3			
" 20	" Ripper & Kye, Ltd.	Flour	L. 4				23	7	6			
" "	" Kingston, Ltd.......	Reprs. to Counter	P.L. 6				2	14	0			
" "	" Wingate & Co.......	Oven reprs.	P.L. 7				2	10	0			
" "	" Slipper & Thomas...	Bags	L. 6	0	1	8	3	19	10			
" "	" Gas Co.	Gas	P.L. 17				8	2	5			
" 26	" Ripper & Kye, Ltd.	Flour	L. 4				40	0	0			
" "	" Smart Advert. Co...	Advert.	P.L. 23				2	2	6			
" "	" Auditor's Fees.......	—	P.L. 24				3	3	0			
" 29	" Sewell & Snap.......	G.P.	L. 5	0	4	1	16	0	5			
" "	" Telephone Calls......	—	P.L. 24				1	9	0			
" "	" Cheque Book.........	—	P.L. 24				0	8	4			
										421	4	11
			P.L. 25	3	10	9						
" 31	By Balance as per Bankers' Book						54	19	3	54	19	3
							476	4	2	476	4	2

	£	s.	d.
Dr.	926	12	4
Not Cleared	56	18	10
	983	11	2

	£	s.	d.
Cr.	912	11	6
Not Cleared......	16	0	5
Balance as above	54	19	3
	983	11	2

ANALYSIS BOOK

1 DAILY EXPENSES

Date.	Private Drawings.			Household.			General Purchases.			Wages.			Coals.			Bags, Books, and Stationery.			Bakehouse Tools.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
July 1							0	18	0												
" 2				1	2	3	0	16	0							1	7	6			
" 3	0	10	0	0	3	4	1	6	2	12	12	6									
" 5							1	0	3										0	8	4
" 6				0	13	6	0	19	2												
" 7				0	9	8	2	1	6				2	6	9						
" 8				0	6	5	0	18	3												
" 9							0	16	9												
" 10	0	15	0	1	10	7	0	19	3	12	12	6									
" 12				0	3	8	0	15	4												
" 13	0	10	0				0	14	2												
" 14				0	12	4	0	19	3										0	11	2
" 15				1	0	2	1	3	6												
" 16							0	10	1							0	12	6			
" 17	0	5	0	0	14	10	1	1	2	12	12	6									
" 19				0	10	9	0	9	8												
" 20				0	6	8	0	15	4												
" 21							0	18	3	0	3	2									
" 22	1	0	0				0	13	7												
" 23				1	0	4	1	5	3				2	6	9				0	6	3
" 24							0	19	11	12	12	6									
" 26				0	6	8	0	19	5												
" 27	0	10	0	1	2	1	0	16	2												
" 28							1	10	3												
" 29				0	6	9	1	10	11												
" 30							0	19	10												
" 31	0	10	0	0	2	4	1	5	8	13	2	6				1	0	4	0	13	11
	4	0	0	10	12	4	27	3	1	63	15	8	4	13	6	3	0	4	1	19	8
	P.L. 2			P.L. 12			P.L. 11			P.L. 13			P.L. 20			P.L. 21			P.L. 7		

ANALYSIS BOOK

JULY, 19...

Credit Accounts Paid.				Horse and Delivery Expenses.			Advertising.			Trade Expenses.									Total.		
NAME.	Amount.																				
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
				0	4	0				1	2	0							2	4	0
										0	12	2							3	17	11
										0	6	8							14	18	8
										0	13	10							2	2	5
				3	7	6				0	4	6							5	4	8
										0	1	1							4	19	0
										0	12	0							1	16	8
										1	0	3							1	17	0
										0	9	8							16	7	0
Pershaw, Smith, & Co (L. 2)......	3	0	9							0	12	6							4	12	3
										0	14	8							1	18	10
				2	12	10				1	0	0							5	15	7
							0	10	0	0	2	6							2	16	2
										0	18	7							2	1	2
										1	2	0							15	15	6
										0	13	8							1	14	1
										0	6	7							1	8	7
										0	1	2							1	2	7
				1	9	2				0	8	3							3	11	0
										0	18	0							5	16	7
										1	13	0							15	5	5
										0	8	2							1	14	3
										0	14	4							3	2	7
										1	1	2							2	11	5
										0	9	8							2	7	4
										0	5	9							1	5	7
				2	12	4	0	12	6	0	11	9							20	11	4
	3	0	9	10	5	10	1	2	6	17	3	11							146	17	7
				P.L. 22			P.L. 23			P.L. 24									C.B. 1		

JOURNAL OR DAY BOOK

JULY, 19...

			£	s.	d.	£	s.	d.
	1							
July 2	Jackson & Co. —							
	1 Case 1200 Eggs at 8/6		5	2	0			
	1 Cask Butter, 1 cwt. 3 lb. at 107/	L. 1	5	9	10	10	11	10
	2							
" 3	Pit Flour Co., Ltd.—							
	25 Sacks Whites at 27/6	L. 3				34	7	6
	3							
" 5	Pershaw, Smith, & Co.—							
	12 Boxes Biscuits at 2/10		1	14	0			
	4 × 28 lb. Greengage Jam at 32/		1	12	0			
	12 × 7 lb. Strawberry Jam at 36/		1	7	0			
	12 Boxes	L. 2	0	1	0			
	Returns, £1, 12*s.* 6*d.*	L. 2				4	14	0
	4							
" 7	Ripper & Kye, Ltd.—							
	40 Sacks Best Flour at 29/9	L. 4				59	10	0
	5							
" 8	Sewell & Snap—							
	Sultanas and Currants	L. 5				8	8	3
	6							
" 10	Jackson & Co.—							
	2 ½-Cases 600 Eggs at 8/6	L. 1				5	2	0
	7							
" "	Pit Flour Co., Ltd.—							
	5 Sacks Wholemeal at 26/		6	10	0			
	2 " Cones at 23/		2	6	0			
	20 " Whites at 27/6	L. 3	27	10	0	36	6	0
	8							
" "	Sewell & Snap—							
	Almonds, Whole and Ground		3	15	6			
	28 lb. Unsweeted Chocolate at 127/		1	11	9			
	2 cwt. Icing Sugar at 24/6	L. 5	2	9	0	7	16	3
	9							
" 12	Jackson & Co.—							
	½-Case Eggs returned, £2, 11*s.*	L. 1						
	10							
" 14	Slipper & Thomas, Ltd.—							
	10,000 Half-quartern Bags at 4/		2	0	0			
	5,000 1/ Cake Bags		1	2	6			
	2,000 Large Cake Bags	L. 6	0	19	0	4	1	6
	11							
" 16	Sewell & Snap—							
	6 cwt. Castor Sugar at 16/10½		5	1	3			
	4 " Brown " at 15/		3	0	0			
	2 " Crushed Lump at 19/	L. 5	1	18	0	9	19	3
	Carry Forward					180	16	7

			£	s.	d.	£	s.	d.
	Brought Forward......					180	16	7
	12							
July 19	Ripper & Kye, Ltd.—							
	40 Sacks "Violets" at 28/9....................	L. 4				57	10	0
	13							
" "	Jackson & Co.—							
	1 Case 1200 Eggs at 8/9.........................		5	5	0			
	1 Cask Butter, 1 cwt. at 106/.................	L. 1	5	6	0			
						10	11	0
	14							
" 24	Pershaw, Smith, & Co.—							
	1 cwt. Cream of Tartar at 82/................		4	2	0			
	6 × 28 lb. Apricot Jam at 34/..................		2	11	0			
	28 lb. Carraway Seeds at 4*d*..................	L. 2	0	9	4			
						7	2	4
	15							
" "	Ripper & Kye, Ltd.—							
	20 Sacks Best Flour at 29/6....................		29	10	0			
	4 " Wholemeal at 26/.....................		5	4	0			
	2 " Cones at 23/..........................	L. 4	2	6	0			
						37	0	0
	16							
" 27	Sewell & Snap—							
	1 cwt. Citron Peel at 70/......................	L. 5				3	10	0
	17							
" 28	Pit Flour Co., Ltd.—							
	24 Sacks Best Whites at 30/...................	L. 3				36	0	0
	18							
" 29	Jackson & Co.—							
	1 Case 1200 Eggs at 9/3.........................		5	11	0			
	1 Cask Best Butter, 1 cwt. 2 lb. at 106/...	L. 1	5	7	11			
						10	18	11
	19							
" 30	Sewell & Snap—							
	2 cwt. Mixed Peel at 30/6......................		3	1	0			
	1 cwt. Cherries at 7*d*. lb.....		3	5	4			
	28 lb. Strip Cokernut at 38/....................		0	9	6			
	2 cwt. Pearl Sugar at 23/........................		2	6	0			
	4 cwt. Castor Sugar at 16/10...........	L. 5	3	7	4			
						12	9	2
	20							
" "	Pershaw, Smith, & Co.—							
	Essences of Lemon and Vanilla...............	L. 2				5	14	4
						361	12	4
	Summary of Purchases for the Month of July, 19...							
		P.L.						
	Flour..	10	260	13	6			
	General Purchases..................................	11	96	17	4			
	Bags, Books, and Stationery......................	21	4	1	6			
			361	12	4			
	Returns and Allowances for July, 19...							
	General Purchases—							
	Pershaw, Smith, & Co..............................	J. 1	1	12	6			
	Jackson & Co....	J. 2	2	11	0			
		P.L. 11	4	3	6			

Italics denote an entry in red ink.

LEDGER ACCOUNTS

Discount: $2\frac{1}{2}$ % *one month.* 1

Dr. JACKSON & CO., 32 LIME STREET, WILLESDEN, N.W. *Cr.*

		C.B.	£	s.	d.			P.L.	£	s.	d.
July 11	To Cash	1	16	15	8	June 30	By Balance	28	17	4	3
" "	" Discount	"	0	8	7	July 2	" Goods	J. 1	10	11	10
" 12	" Returns	J. 2	2	11	0	" 10	" "	"	5	2	0
" 19	" Cash	C.B. 1	12	16	3	" 19	" "	2	10	11	0
" "	" Discount	"	0	6	7	" 29	" "	3	10	18	11
" 31	" Balance	c/d	21	9	11						
			54	8	0				54	8	0
						" 31	" Balance	b/d	21	9	11

Discount: $1\frac{1}{4}$ % *one month.* 2

Dr. PERSHAW, SMITH, & CO., THE CRESCENT, TOTTENHAM *Cr.*

		J.	£	s.	d.			J.	£	s.	d.
July 5	To Returns	1	1	12	6	July 5	By Goods	1	4	14	0
" 12	" Cash	A.B. 1	3	0	9	" 24	" "	2	7	2	4
" "	" Discount	C.B. 1	0	0	9	" 30	" "	3	5	14	4
" 31	" Balance	c/d	12	16	8						
			17	10	8				17	10	8
						" 31	" Balance	b/d	12	16	8

Discount: 6*d. a sack in* 7 *days.* 3

Dr. PIT FLOUR CO., LTD., VAUXHALL ROAD, REDHAM *Cr.*

		C.B.	£	s.	d.			P.L.	£	s.	d.
July 3	To Cash	1	45	10	0	June 30	By Balance	28	46	7	0
" "	" Discount	"	0	17	0	July 3	" Goods	J. 1	34	7	6
" 10	" Cash	"	69	7	6	" 10	" "	"	36	6	0
" "	" Discount	"	1	6	0	" 28	" "	2	36	0	0
" 31	" Balance	c/d	36	0	0						
			153	0	6				153	0	6
						" 31	" Balance	b/d	36	0	0

No discount allowed. 4

Dr. RIPPER & KYE, LTD., MARK LANE, E.C. *Cr.*

		C.B.	£	s.	d.			P.L.	£	s.	d.
July 7	To Cash	1	50	0	0	June 30	By Balance	28	63	17	6
" 14	" "	"	50	0	0	July 7	" Goods	J. 1	59	10	0
" 20	" "	"	23	7	6	" 19	" "	2	57	10	0
" 26	" "	"	40	0	0	" 24	" "	"	37	0	0
" 31	" Balance	c/d	54	10	0						
			217	17	6				217	17	6
						" 31	" Balance	b/d	54	10	0

Discount: 1½ % *one month.* 5

Dr. SEWELL & SNAP, 36 EPSOM STREET, S.W. Cr.

		C.B.	£	s.	d.			P.L.	£	s.	d.
July 14	To Cash.........	1	23	19	6	June 30	By Balance....	28	24	5	7
" "	" Discount...	"	0	6	1			J.			
" 29	" Cash.........	"	16	0	5	July 8	" Goods......	1	8	8	3
" "	" Discount...	"	0	4	1	" 10	" "	"	7	16	3
" 31	" Balance.....	c/d	25	18	5	" 16	" "	2	9	19	3
						" 27	" "	"	3	10	0
						" 30	" "	3	12	9	2
			66	8	6				66	8	6
						" 31	" Balance....	b/d	25	18	5

Discount: 2 % *in 14 days.* 6

Dr. SLIPPER & THOMAS, LTD., MILTON WORKS, FULHAM. Cr

		C.B.	£	s.	d.			J.	£	s.	d.
July 20	To Cash.........	1	3	19	10	July 14	By Goods......	2	4	1	6
" "	" Discount...	"	0	1	8						
			4	1	6				4	1	6

PRIVATE LEDGER ACCOUNTS

Dr. CAPITAL ACCOUNT Cr. 1

			£	s.	d.			P.L.	£	s.	d.
July 31	To Private Drawings............	P.L. 2	14	2	4	June 30	By Balance.........	28	723	9	0
" "	" Interest—less Tax............	3	1	8	6	July 31	" Net Profit of Business for one month...	27	46	12	5
" "	" Balance.........	c/d	754	10	7						
			770	1	5				770	1	5
						" "	" Balance.........	b/d	754	10	7

Dr. PRIVATE DRAWING ACCOUNT Cr. 2

			£	s.	d.			P.L.	£	s.	d.
July 7	To Cash.............	C.B. 1	6	0	0	July 31	By Capital A/c....	1	14	2	4
" 31	" "	A.B. 1	4	0	0						
" "	" Household Expenses.....	P.L. 12	4	2	4						
			14	2	4				14	2	4

Dr. C. Honk Loan Account *Cr.* 3

			£	s.	d.				£	s.	d.
July 7	To Cash.............	C.B. 1	8	11	0	June 30	By Balance— Principal due	P.L. 28	300	0	0
" 31	" Balance.	c/d	301	8	6		Interest—less Tax	"	8	11	0
						July 31	" Capital A/c for one month's Interest—less Tax	P.L. 1	1	8	6
			309	19	6				309	19	6
						" "	" Balance.........	b/d	301	8	6

Dr. Horse Stock Account *Cr.* 4

		P.L.	£	s.	d.				£	s.	d.
June 30	To Stock on hand (S.B. 4)............	28	35	0	0	July 31	By Profit and Loss A/c......	P.L. 27	0	10	0
						" "	" Balance........	c/d	34	10	0
			35	0	0				35	0	0
July 31	" Balance.........	b/d	34	10	0						

Dr. Vans, Carts, and Harness Stock Account *Cr.* 5

			£	s.	d.				£	s.	d.
June 30	To Stock on hand (S.B. 6).........	P.L. 28	67	10	6	July 31	By Profit and Loss A/c for maintenance	P.L. 27	2	5	0
July 14	" Van Repairs, per Davis & Porter.........	C.B. 1	3	14	6	" "	" Stock on hand (S.B. 6).........	c/d	69	0	0
			71	5	0				71	5	0
" 31	" Stock on hand	b/d	69	0	0						

Dr. Shop Fixtures, Fittings, and Sundries Account *Cr.* 6

			£	s.	d.				£	s.	d.
June 30	To Balance (S.B. 7)	P.L. 28	79	3	4	July 31	By Profit and Loss A/c for maintenance	P.L 27	2	17	4
July 20	" Repairs to Shop Counter	C.B. 1	2	14	0	" "	" Balance.........	c/d	79	0	0
			81	17	4				81	17	4
" 31	" Balance.........	b/d	79	0	0						

Dr. BAKEHOUSE TOOLS AND UTENSILS-IN-TRADE ACCOUNT Cr. 7

			£	s.	d.				£	s.	d.
June 30	To Stock on hand (S.B. 8).........	P.L. 28	86	2	7	July 31	By Profit and Loss A/c for maintenance of Ovens and Tools..........	P.L. 27	3	12	3
July 20	" Oven Repairs	C.B. 1	2	10	0	" "	" Balance.........	c/d	87	0	0
" 31	" Cash Purchases.........	A.B. 1	1	19	8						
			90	12	3				90	12	3
" "	" Balance.........	b/d	87	0	0						

Dr. HIRE STOCK ACCOUNT Cr. 8

			£	s.	d.				£	s.	d.
June 30	To Stock on hand (S.B. 9).........	P.L. 28	54	5	9	July 31	By Profit and Loss A/c......	P.L. 27	0	9	1
						" "	" Balance.........	c/d	53	16	8
			54	5	9				54	5	9
July 31	" Balance...	b/d	53	16	8						

Dr. GOODWILL ACCOUNT Cr. 9

			£	s.	d.				£	s.	d.
June 30	To Balance.........	P.L. 28	500	0	0						

Dr. FLOUR ACCOUNT Cr. 10

			£	s.	d.				£	s.	d.
June 30	To Stock on hand (S.B. 1).........	P.L. 28	64	10	0	July 31	By Profit and Loss A/c for amount consumed.........	P.L. 27	265	18	6
July 31	" One Month's Purchases......	J. 3	260	13	6	" "	" Stock on hand (S.B. 1).........	c/d	59	5	0
			325	3	6				325	3	6
" "	" Stock on hand	b/d	59	5	0						

Dr. **General Purchases Account** *Cr.* 11

			£	s.	d.				£	s.	d.
June 30	To Stock on hand (s.b. 2).........	P.L. 28	58	3	2	July 31	By Returns.........	J. 3	4	3	6
July 31	" Cash Purchases	A.B. 1	27	3	1	" "	" Profit and Loss A/c for amount consumed.........	P.L. 27	116	17	10
" "	" Credit Purchases	J. 3	96	17	4	" "	" Stock on hand (s.b. 2).........	c/d	61	2	3
			182	3	7				182	3	7
" "	" Stock on hand	b/d	61	2	3						

Dr. **Household Expenses and Keep of Assistants Account** *Cr.* 12

			£	s.	d.				£	s.	d.
July 31	To Cash............	A.B. 1	10	12	4	July 31	By Profit and Loss A/c for keep of Assistants.......	P.L. 27	6	10	0
						" "	" Private Drawing A/c........	2	4	2	4
			10	12	4				10	12	4

Dr. **Wages Account** *Cr.* 13

			£	s.	d.				£	s.	d.
July 31	To Cash............	A.B. 1	63	15	8	July 31	By Profit and Loss A/c......	P.L. 27	63	15	8

Dr. **Rent Account** *Cr.* 14

			£	s.	d.				£	s.	d.
July 14	To Cash............	C.B. 1	27	10	0	June 30	By Balance due to R. Jones......	P.L. 28	27	10	0
" 31	" Balance Rent for One Month	c/d	9	3	4	July 31	" Profit and Loss A/c......	27	9	3	4
			36	13	4				36	13	4
						" "	" Balance due R. Jones......	b/d	9	3	4

Dr. **Local Rates Account** *Cr.* 15

			£	s.	d.				£	s.	d.
July 31	To Proportion of Rates due...	c/d	3	5	2	July 31	By Profit and Loss A/c......	P.L. 27	3	5	2
						" "	" Balance due...	b/d	3	5	2

Dr. **Insurance Account** *Cr.* 16

			£	s.	d.				£	s.	d.
July 12	To Cash per Jenkins............	C.B. 1	1	3	6	July 31	By Profit and Loss A/c......	P.L. 27	1	3	6

Dr. **Gas Account** *Cr.* 17

		C.B.	£	s.	d.			P.L.	£	s.	d.
July 20	To Cash............	1	8	2	5	June 30	By Balance due...	28	8	2	5
" 31	" Balance due...	c/d	3	2	0	July 31	" Profit and Loss A/c......	27	3	2	0
			11	4	5				11	4	5
						" "	" Balance due...	b/d	3	2	0

Dr. **Electric Light Account** *Cr.* 18

			£	s.	d.			P.L.	£	s.	d.
July 31	To Balance.........	c/d	6	19	1	June 30	By Balance due...	28	5	1	4
						July 31	" Profit and Loss A/c......	27	1	17	9
			6	19	1				6	19	1
						" "	" Balance due...	b/d	6	19	1

Dr. **Water Account** *Cr.* 19

			£	s.	d.			P.L.	£	s.	d.
July 31	To Proportion of Rate due.....	c/d	3	0	0	June 30	By Balance due...	28	2	5	0
						July 31	" Profit and Loss A/c......	27	0	15	0
			3	0	0				3	0	0
						" "	" Balance due...	b/d	3	0	0

Dr. **Coals Account** *Cr.* 20

			£	s.	d.				£	s.	d.
June 30	To Stock on hand	P.L. 28	0	17	6	July 31	By Profit and Loss A/c......	P.L. 27	4	16	0
July 31	" Cash............	A.B. 1	4	13	6	" "	" Stock on hand	c/d	0	15	0
			5	11	0				5	11	0
" "	" Stock on hand	b/d	0	15	0						

Dr. BAGS, BOOKS, PAPER, AND STATIONERY ACCOUNT *Cr.* 21

			£	s.	d.				£	s.	d.
June 30	To Stock on hand (S.B. 3).........	P.L. 28	13	9	6	July 31	By Profit and Loss A/c......	P.L. 27	7	4	4
July 31	" Cash Purchases	A.B. 1	3	0	4	" "	" Stock on hand (S.B. 3).........	c/d	13	7	0
" "	" Credit Purchases	J. 3	4	1	6						
			20	11	4				20	11	4
" "	" Stock on hand	b/d	13	7	0						

Dr. HORSE AND DELIVERY EXPENSES ACCOUNT *Cr.* 22

			£	s.	d.				£	s.	d.
June 30	To Stock on hand (S.B. 5) of Forage..............	P.L. 28	2	10	0	July 31	By Profit and Loss A/c......	P.L. 27	11	10	10
July 31	" Cash	A.B. 1	10	5	10	" "	" Stock on hand (S.B. 5).........	c/d	1	5	0
			12	15	10				12	15	10
" "	" Stock on hand of Forage.....	b/d	1	5	0						

Dr. ADVERTISING ACCOUNT *Cr.* 23

			£	s.	d.				£	s.	d.
July 26	To Smart Advert. Co..............	C.B. 1	2	2	6	July 31	By Profit and Loss A/c......	P.L. 27	3	5	0
" 31	" Cash	A.B. 1	1	2	6						
			3	5	0				3	5	0

Dr. TRADE EXPENSES ACCOUNT *Cr.* 24

		C.B.	£	s.	d.				£	s.	d.
July 26	To Auditor's Fee	1	3	3	0	July 31	By Profit and Loss A/c................	P.L. 27	22	4	3
" 29	" Telephone Calls...........	"	1	9	0						
" "	" Cheque Book..	"	0	8	4						
" 31	" Cash Sundries	A.B. 1	17	3	11						
			22	4	3				22	4	3

Dr. DISCOUNT ACCOUNT *Cr.* 25

			£	s.	d.				£	s.	d.
July 31	To Profit and Loss A/c................	P.L. 27	3	10	9	July 31	By Sundries........	C.B. 1	3	10	9

A Trial Balance is a summary of the balances of the accounts after all the posting has been done, but before the stocks have been entered, in order to test the accuracy of the books before proceeding to make out the profit and loss accounts or balance sheet. Thus the trial balance of the accounts given off will be as follows:—

Trial Balance.

Dr. TRIAL BALANCE, 31st July, 19... *Cr.*

	C.B.	£	s.	d.		L.	£	s.	d.
Cash at Bank	1	54	19	3	Jackson & Co.	1	21	9	11
Cash in hand, &c.	2	15	1	0	Pershaw, Smith, & Co.	2	12	16	8
	P.L.				Pit Flour Co., Ltd.	3	36	0	0
Private Drawing A/c	2	10	0	0	Ripper & Kye, Ltd.	4	54	10	0
Horse Stock A/c	4	35	0	0	Sewell & Snap	5	25	18	5
Vans, Carts, and Harness Stock A/c	5	71	5	0			150	15	0
Shop Fixtures, &c., A/c	6	81	17	4		P.L.			
Bakehouse Tools A/c	7	90	12	3	Capital A/c	1	723	9	0
Hire Stock A/c	8	54	5	9	C. Honk Loan A/c	3	300	0	0
Goodwill A/c	9	500	0	0	Electric Light A/c	18	5	1	4
Flour A/c	10	325	3	6	Water A/c	19	2	5	0
General Purchases A/c	11	178	0	1	Discount A/c	25	3	10	9
Household Expenses, &c., A/c	12	10	12	4	Gross Profit and Loss A/c—Takings	26	601	9	9
Wages A/c	13	63	15	8					
Insurance A/c	16	1	3	6					
Coals A/c	20	5	11	0					
Bags, Books, &c., A/c	21	20	11	4					
Horse and Delivery Expenses A/c	22	12	15	10					
Advertising A/c	23	3	5	0					
Trade Expenses A/c	24	22	4	3					
Book Debts	26	230	7	9					
		1786	10	10			1786	10	10

GROSS PROFIT AND LOSS ACCOUNT

Dr. From 30th June to 31st July, 19... *Cr.* 26

		P.L.	£	s.	d.				£	s.	d.
June 30	To Book Debts	28	230	7	9	July 31	By Takings— Customers A/cs Paid £240 3s. 6d.	C.B. 1			
July 31	" Flour consumed	10	265	18	6		Carmen: Amt. brt. in 192 11 2	"			
" "	" General Purchases consumed	11	116	17	10		Shop Takings 168 15 1	"	601	9	9
" "	" Balance being Gross Profit	27	191	8	2	" "	By Book Debts	c/d	203	2	6
			804	12	3				804	12	3
" "	" Book Debts	b/d	203	2	6						

NET PROFIT AND LOSS ACCOUNT

Dr. FROM 30TH JUNE TO 31ST JULY, 19... *Cr.* 27

	P.L.	£	s.	d.		P.L.	£	s.	d.
To Keep of Assistants	12	6	10	0	By Gross Profit...	26	191	8	2
" Wages	13	63	15	8	" Discount	25	3	10	9
" Rent	14	9	3	4					
" Local Rates	15	3	5	2					
" Insurance	16	1	3	6					
" Gas	17	3	2	0					
" Electric Light	18	1	17	9					
" Water	19	0	15	0					
" Coals	20	4	16	0					
" Bags, Books, Paper, and Stationery	21	7	4	4					
" Horse and Delivery Expenses	22	11	10	10					
" Advertising	23	3	5	0					
" Trade Expenses	24	22	4	3					
" Maintenance of—									
Horse Stock	4	0	10	0					
Vans, Carts, &c., Stock	5	2	5	0					
Shop Fixtures, Fittings, and Sundries	6	2	17	4					
Bakehouse Tools and Ovens	7	3	12	3					
Hire Stock	8	0	9	1					
" Balance being Net Profit	1	46	12	5					
		194	18	11			194	18	11

Many bakers and confectioners find it inconvenient to take stock any other day in the week than Saturday. In order to overcome this difficulty they make their quarter, half-year, or year an exact number of weeks. Thus, if a baker made his opening balance sheet on Saturday, June 26, his quarter would end on Saturday, September 25, or his half-year on Saturday, December 25. In the Cash Book and Analysis Book his months would be from June 26 to July 25, from July 26 to August 25, from August 26 to September 25, &c.

Stock-taking.

It is also often difficult to revalue the bakehouse tools, hire stock, horse stock, vans, carts, and harness stock, &c., every quarter. Many bakers prefer to leave the consideration of the maintenance of these stocks to the end of their financial year, the amounts for the year being then deducted from the four quarterly or two half-yearly net profits—which have been obtained in the manner shown above—and the residual net profit for the year carried to capital account.

Bills Payable and Receivable.

It may sometimes be the case that a baker and confectioner is asked to accept bills payable at future dates in payment of goods received. If he does so, a bills payable account should be opened in the Private Ledger, and the amount of the bill credited to this account and debited to the Ledger account of the firm who had

BALANCE SHEET, 31st July, 19...

Dr. CAPITAL AND LIABILITIES

				P.L.	£	s.	d.
To Capital				1	754	10	7
" C. Honk Loan A/c				3	300	0	0
" Interest accrued on same—less Tax				"	1	8	6
" Trade and General Creditors—				L.			
Jackson & Co.	£21	9	11	1			
Pershaw, Smith, & Co.	12	16	8	2			
Pit Flour Co., Ltd.	36	0	0	3			
Ripper & Kye, Ltd.	54	10	0	4			
Sewell & Snap	25	18	5	5			
				P.L.			
R. Jones (Rent)	9	3	4	14			
Gas Co.	3	2	0	17			
Electric Light Co.	6	19	1	18			
Local Rates	3	5	2	15			
Water	3	0	0	19			
					176	4	7
					1232	3	8

ASSETS *Cr.*

	C.B.	£	s.	d.
By Cash at Bank	1	54	19	3
" Cash in hand	2	8	1	0
" Cash—Till Money	"	2	0	0
" Cash—Petty Cash for Expenses	"	5	0	0
	P.L.			
" Book Debts	26	203	2	6
" Flour Stock	10	59	5	0
" General Purchases Stock	11	61	2	3
" Bags, Books, Paper, and Stationery Stock	21	13	7	0
" Coals Stock	20	0	15	0
" Horse Stock	4	34	10	0
" Forage Stock	22	1	5	0
" Vans, Carts, and Harness Stock	5	69	0	0
" Shop Fixtures, Fittings, and Sundries	6	79	0	0
" Bakehouse Tools and Utensils in Trade	7	87	0	0
" Hire Stock	8	53	16	8
" Goodwill	9	500	0	0
		1232	3	8

supplied the goods. The date on which the bill is due should be noted in the bills payable account, and when it is met, the cash in payment should be posted to this account from the Cash Book, thus:—

Dr. BILLS PAYABLE ACCOUNT *Cr.*

		C.B.	£	s.	d.				£	s.	d.
Nov. 17	To Cash............	5	56	8	5	Aug. 14	By Limpton & Son (due Nov. 17, 1909)...............	L. 140	56	8	5

Dr. LIMPTON & SON, 93 KING STREET, HENMOOR *Cr.*

			£	s.	d.			J.	£	s.	d.
Aug. 14	To Bill Payable (due Nov. 17, 1909).............	P.L. 64	56	8	5	June 26	By Goods...........	9	24	6	3
						July 14	" "	15	32	2	2
			56	8	5				56	8	5

In the event of a bill receivable being drawn by the baker and confectioner and accepted by a customer in payment of bread, smalls, &c., supplied, a bills receivable account should be opened. The amount of the bill should be *debited* to this account, and entered as takings in the gross profit and loss account. When the bill is met, the cash received should be posted to the bills receivable account from the cash summary.

It will at once be obvious to the reader that, where the business consists of several shops, each will need its own Takings Book and Expenses Book. If only the profit and loss account of the business as a whole is needed, all the extra accounts required will be (1) a page in the Analysis Book, and (2) a debit page in the Cash Book for each month for each shop. For making the entries in these books it will generally be found convenient for each shop to forward to the office a slip of paper showing (1) a list of the expenses for the previous day, and (2) the amounts of the customers' accounts paid, carmen's takings, shop takings, and amount banked. The former will be entered in the Analysis Book and the latter in the Cash Book. If the cash is collected from each shop and banked in one account, before banking the amounts should be agreed with the figures supplied. The invoices should be checked by the manager, initialed, and forwarded to the office to be entered in the Journal in the ordinary manner.

Accounts Relating to Branch Shops.

Where it is desired to know the profit or loss made by each shop, some further detail will be necessary. In the first place it will be absolutely essential for a complete record to be made of the goods transferred from one shop to another. The value assigned should represent the current wholesale price, and should allow of a profit to each shop.

It will also be necessary to mark each invoice in the Journal (or Day Book), showing to which shop the goods were delivered, and at the end of the quarter, half-year, or year, a separate analysis will have to be made out for each shop. An alternative method is to keep a separate Journal (or Day Book) for each. A separate system of impersonal accounts will have to be kept for each shop in the Private Ledger, and every cheque drawn, not in payment of a Ledger account, must have written against it in the Cash Book the address or other distinguishing mark of the shop on account of which the payment was made. In posting from the Analysis Book, Cash Book, or Journal, great care must be taken to charge the amounts to the right shop. With regard to the transfers spoken of above, let it be supposed that of two shops, A and B, A receives goods valued £32 from B in July, and that in the same period B receives goods valued £57 from A. At the end of the month B's general purchases account will be debited with the £57, while A's gross profit and loss account will have this amount added to the takings, and vice versa.

Above it has been understood that only *one* banking account was kept. If a separate banking account is kept for each shop, it will be more simple to have a Cash Book and an Analysis Book for each shop.

PRIVATE ESTATE ACCOUNTS

The system of bookkeeping which has been shown can include, if desired, that of a baker's private estate. In the description of the quarterly cash summary account reference has been made to the receipts and payments in respect of the private estate. These, if it is wished to have *no* private accounts whatever, must be entered direct to the capital account. If, however, this is done, the capital account will not show what has been received during a certain period for private revenue in the same way that the business profit has been found; nor, again, can the investor know which of his private assets has resulted in procuring the best return on his capital.

Value of Private Account.

If, on the other hand, accounts are desired for the private estate, they may be opened in the following manner. Let it be supposed that on the 1st of July the baker possessed the following property:—

Freehold premises, 9 Coleman Street, S.E., which cost	£1000
Leasehold premises, 62 Hart Street, Hamley, which cost	800
Ordinary shares in Robinson, Ltd.	50
Household furniture	300
Amount paid for life insurance	100

Also, that an advance of £500 had been obtained on security of the freehold premises of 9 Coleman Street, S.E., from the London Assurance Company, at 6 per cent, interest payable quarterly. Further, that the leasehold premises and ordinary shares have been fully paid, and that

nothing is due on the household furniture or life insurance. In connection with the leasehold premises, 62 Hart Street, Hamley, let it be supposed that the ground rent of £10 per annum is due for the previous half-year (£5). From these particulars the balance sheet on 1st July for the private estate would be drawn up as follows, and should be entered on a page in the Private Ledger:—

BALANCE SHEET, 1st July, 19...

(*Private Estate only*)

Capital and Liabilities	P.L.	£	s.	d.	Assets	P.L.	£	s.	d.
To Capital..................	1	1745	0	0	By Freehold Premises of 9 Coleman St., S.E., at Cost.......	205	1000	0	0
" Mortgage (on security of 9 Coleman St., S.E.) to London Assurance Co.	210	500	0	0	" Leasehold Premises of 62 Hart St., Hamley, at Cost..	215	800	0	0
" Creditor for Ground Rent (62 Hart St., Hamley)............	217	5	0	0	" Ordinary Shares—Robinson, Ltd.....	220	50	0	0
					" Household Furniture..................	224	300	0	0
					" Life Insurance Policy — Amount paid thereon.......	226	100	0	0
		2250	0	0			2250	0	0

Accounts for all the above assets and the mortgage should now be opened in the Private Ledger, and would appear as follows:—

205

Dr. No. 9 Coleman Street, S.E.—Freehold Premises Capital Account *Cr.*

		P.L.	£	s.	d.			P.L.	£	s.	d.
July 1	To Balance of Cost...............	201	1000	0	0						

210

Dr. London Assurance Co.—Mortgage Account on Security of 9 Coleman Street, S.E. *Cr.*

		P.L.	£	s.	d.			P.L.	£	s.	d.
						July 1	By Amount due...	201	500	0	0

215

Dr. No. 62 Hart Street, Hamley.—Leasehold Premises Capital Account *Cr.*

		P.L.	£	s.	d.			P.L.	£	s.	d.
July 1	To Balance of Cost...............	201	800	0	0						

220

Dr. Ordinary Shares in Robinson, Ltd.—Capital Account Cr.

			£	s.	d.				£	s.	d.
July 1	To Cost.............	P.L. 201	50	0	0						

225

Dr. Household Furniture—Capital Account Cr.

			£	s.	d.				£	s.	d.
July 1	To Valuation or Cost...............	P.L. 201	300	0	0						

230

Dr. Life Insurance—Capital Account Cr.

			£	s.	d.				£	s.	d.
July 1	To Amount paid	P.L. 201	100	0	0						

The balance of capital must be transferred to the same capital account as used in the business. At the commencement this would appear thus:—

Dr. Capital Account Cr.

			£	s.	d.				£	s.	d.
						July 1	By Business Capital.......	P.L. 195	725	5	0
						" "	" Private Estate Capital.......	201	1745	0	0
									2470	5	0

As each of the three investments noted will produce an income of its own, a revenue account must be opened for each. The following accounts show not only the starting, but also how they may look after a period of six months, and how they are balanced when it is desired to close the accounts.

207

Dr. No. 9 Coleman Street, S.E.—Revenue Account Cr.

			£	s.	d.				£	s.	d.
Nov. 2	To Repairs............	C.B. 6	2	19	6	Aug. 4	By Rent—less Tax..	C.B. 2	28	10	0
Dec. 12	" "	7	12	3	6	" "	" Income Tax deducted..........	P.L. 234	1	10	0
" 31	" Private Estate Revenue A/c...	P.L. 240	44	17	0	Oct. 21	" Rent—less Tax..	C.B. 4	28	10	0
						" "	" Income Tax deducted...........	P.L. 234	1	10	0
			60	0	0				60	0	0

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Dr. No. 62 Hart Street, Hamley—Revenue Account *Cr.*

			£	s.	d.				£	s.	d.
Aug. 19	To Cash for Ground Rent	C.B. 2	4	15	0	July 1	By Ground Rent due	P.L. 201	5	0	0
" "	" Income Tax deducted	P.L. 232	0	5	0	" 10	" Rent received...	C.B. 4	16	12	6
Nov. 12	" Repairs	C.B. 6	10	7	3	" "	" Income Tax deducted	P.L. 234	0	17	6
Dec. 31	" Private Estate Revenue A/c...	P.L. 240	19	12	9	Oct. 7	" Rent received...	C.B. 8	16	12	6
" "	" Ground Rent due	c/d	5	0	0	" "	" Income Tax deducted	P.L. 234	0	17	6
			40	0	0				40	0	0
						Dec. 31	" Ground Rent due	b/d	5	0	0

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Dr. Ordinary Shares in Robinson, Ltd.—Revenue Account *Cr.*

			£	s.	d.				£	s.	d.
Dec. 31	To Private Estate Revenue A/c.....	P.L. 240	3	0	0	July 16	By Dividend	C.B. 4	1	8	6
						" "	" Income Tax deducted	P.L. 234	0	1	6
						Oct. 20	" Dividend	C.B. 8	1	8	6
						" "	" Income Tax deducted	P.L. 234	0	1	6
			3	0	0				3	0	0

A perusal of the above shows (1) that the ground rent due in the opening balance sheet must be posted to the credit of the corresponding revenue account; (2) that where income tax is deducted from rent, &c., received or paid, the amount of the same should be entered under the cash; (3) that when repairs are paid for, the cash or cheque in payment of the same must be posted to the revenue account of the property on which the repairs were executed, just as if it were in payment of an ordinary Ledger account; (4) that at the end of the half-year or other period the excess of the credits over the debits is transferred to the private estate revenue account; in the case of the leasehold premises the ground rent due is inserted and brought down.

Two more accounts must now be entered; these are:—

1. Interest account.
2. Property and income-tax account.

In the interest account is debited the interest paid to the London Assurance Company, together with the income tax deducted from the same. At the end of the six months or other period the total is transferred to the private estate revenue account.

In the property and income-tax account are debited the tax deducted from the rents, &c., *received*, and the tax deducted from the interest and ground rent *paid* is credited. Its balance at the end of the half-year is carried to the private estate revenue account.

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Dr. INTEREST ACCOUNT *Cr.*

		C.B.	£	s.	d.				£	s.	d.
July 23	To Cash to London Assurance Co.		7	2	6	Dec. 31	By Private Estate Revenue A/c......	P.L. 240	15	0	0
" "	" Income Tax deducted............	P.L. 234	0	7	6						
Oct. 26	" Cash to London Assurance Co.	C.B. 5	7	2	6						
" "	" Income Tax deducted............	P.L. 234	0	7	6						
			15	0	0				15	0	0

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Dr. PROPERTY AND INCOME-TAX ACCOUNT *Cr.*

			£	s.	d.				£	s.	d.
Dec. 31	To 9 Coleman St. Revenue A/c...	P.L. 207	3	0	0	Dec. 31	By 62 Hart St., Hamley (deducted from Ground Rent)	P.L. 217	0	5	0
" "	" 62 Hart St., Hamley, Revenue A/c.......	217	1	15	0	" "	" London Assurance Co.........	232	0	15	0
" "	" Robinson, Ltd., Revenue A/c...	222	0	3	0	" "	" Private Estate Revenue A/c.	240	3	18	0
			4	18	0				4	18	0

The account to which attention must now be turned is the private estate revenue account. From the references made to this account its purpose may have been anticipated. It takes the same place and serves the same purpose in the private estate accounts that the net profit and loss account does in the business accounts. In it are debited the balances of what may be termed the expense accounts. These in the sample accounts being shown will be (1) the balance of the interest account, and (2) that of the property and income-tax account. On the credit side of this account are placed the balances of the revenue accounts. If a property has been unlet, and repairs have been done, the balance of its revenue account will fall on the credit side, and hence will be posted to the debit or expense side of the private estate revenue account.

Revenues from Property.

The excess of the total of the credit side of the private estate revenue account over that of the debit will give the net profit derived from the private estate during the six months or other period. If, perchance, the

reverse is the case, a net loss will have been made. This balance of profit or loss must be entered and the account closed. Furthermore, the net profit must be carried to the credit of the capital account, or, if net loss, to the debit.

The sample accounts already given will furnish the following private estate revenue account:—

PRIVATE ESTATE REVENUE ACCOUNT FROM 1ST JULY, 19... TO 31ST DECEMBER, 19...

Dr. | *Cr.*

		P.L.	£	s.	d.			P.L.	£	s.	d.
	To Interest on Mortgage............	232	15	0	0		By No. 9 Coleman St., S.E., Revenue A/c.......	207	44	17	0
	" Income Tax	234	3	18	0		" No. 62 Hart St., Hamley, Revenue A/c........	217	19	12	9
	" Balance being *Net Profit* carried to Capital A/c... ...	1	48	11	9		" Dividend on Shares in Robinson, Ltd..........	222	3	0	0
			67	9	9				67	9	9

If during the period some of the mortgage is paid off, the cash in payment of the same must be debited direct to the mortgage account, and at the end of the period the balance is brought down, thus:—

LONDON ASSURANCE CO.—MORTGAGE ACCOUNT ON SECURITY OF NO. 9 COLEMAN STREET, S.E.

Dr. | *Cr.*

		C.B.	£	s.	d.			P.L.	£	s.	d.
Dec. 24	To Cash............	7	50	0	0	July 1	By Amount due...	201	500	0	0
" 31	" Balance...	c/d	450	0	0						
			500	0	0				500	0	0
						Dec. 31	" Balance.........	b/d	450	0	0

If, again, some fresh capital has been invested (say) in the purchase of freehold land at Tilsberry, an account must be opened for this. Also, if it is to be paid for in instalments, an account must be opened for the person from whom the land is bought, thus:—

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Dr. FREEHOLD LAND, TIMBER STREET, TILSBERRY—CAPITAL ACCOUNT *Cr.*

		P.L.	£	s.	d.						
Sept. 25	To Cost of Purchase..........	238	250	0	0						

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Dr. E. K. Jones, Esq. *Cr.*

		C.B.	£	s.	d.			P.L.	£	s.	d.
Sept. 25	To Deposit Paid...	3	75	0	0	Sept. 25	By Freehold Land bought.........	236	250	0	0
Oct. 29	" Cash..............	5	12	10	0						
Nov. 29	" "	6	12	10	0						
Dec. 27	" "	7	25	0	0						
" 31	" Balance..........	c/d	125	0	0						
			250	0	0				250	0	0
						Dec. 31	" Balance..........	b/d	125	0	0

At the end of the six months or other period the accounts are closed and the balance sheet made out. It is necessary to state that the private estate accounts must be closed at the same time as those of the business. It is not essential that the books should be balanced every half-year; yet experience has shown that this is the most desirable period. Following out the sample accounts, the balance sheet for the private estate would stand on the 31st December thus:—

BALANCE SHEET, 31st December, 19...

(*Private Estate only*)

Dr. Capital and Liabilities — Assets *Cr.*

	P.L.	£	s.	d.		P.L.	£	s.	d.
To Capital............	1	1920	0	0	By Freehold Premises of 9 Coleman St., S.E., at Cost...........	205	1000	0	0
" Mortgage (on security of 9 Coleman St., S.E.) to London Assurance Co......	210	450	0	0	" Leasehold Premises of 62 Hart St., Hamley, at Cost...............	215	800	0	0
" E. K. Jones for Balance of Purchase Money on Freehold Land..............	238	125	0	0	" Freehold Land Timber St., Tilsberry, at Cost...............	236	250	0	0
" Creditor for Ground Rent..	217	5	0	0	" Ordinary Shares in Robinson, Ltd.	220	50	0	0
					" Household Furniture............	224	300	0	0
					" Life Insurance Policy, amount paid thereon...	226	100	0	0
		2500	0	0			2500	0	0

A few words in closing may be said about the joint capital account. In balancing the business and private estate accounts the sum of the capitals obtained from the balance sheets should be identical with the balance of the capital account. The following speaks for itself.

Dr. CAPITAL ACCOUNT *Cr.*

			£	s.	d.				£	s.	d.
Dec. 31	To Private Drawings A/c......	P.L. 12	50	0	0	July 1	By Business Capital	P.L. 195	725	5	0
" "	" Interest on Business Loan..........	100	17	11	0	" "	" Private Estate Capital...........	201	1745	0	0
									2470	5	0
" "	" Household and Living Expenses.....	20	38	8	6	Dec. 31	" Net Profit of Business for Half-year........	153	110	14	6
" "	" Balance of Capital.......	c/d	2523	11	9	" "	" Net Profit of Private Estate for Half-year...	240	48	11	9
			2629	11	3				2629	11	3
							By Balance, viz.:— Business Capital £603 11 9	P.L. 196			
							Private Estate Capital 1920 0 0	202			
								b/d	2523	11	9

CHAPTER X

THE OFFICE

In no department of a works is it more necessary to have a properly organized system than in the office, as this is the centre from which all the other departments are directed, and should it be defective, the efficiency of the departments depending upon it will be greatly impaired. Not only has the conduct of the departments inside the works to be controlled by the office, but also the commercial section, relating to all extraneous negotiations. It is necessary in the conduct of any business to record in writing all transactions that take place, and arrangements must be made to enable the documents of various kinds to be dealt with promptly, applied to their particular purpose, and stored in such a manner as to facilitate easy reference. To effect this purpose economically, up-to-date offices are provided with systems of books and files in addition to the usual furniture. Of late years filing cabinets and card systems have been introduced, and are now considered indispensable. Besides these it is necessary to provide machines for writing, copying, and calculating, which are too well known to require description.

System in the Office.

Filing cabinets, of which there are several designs, are arranged to file documents, such as correspondence, invoices, orders, &c., in such a manner as to be easy of reference. The systems most generally adopted are what are known as *flat* and *vertical* filing, the former being considered preferable where the majority of the documents to be filed consist of single papers, and the latter where many

Filing Cabinets.

documents referring one to another are filed together. The cabinets usually comprise one or more files or drawers, as the case may be, each file being subdivided either alphabetically, numerically, or to meet specific requirements. Cabinet

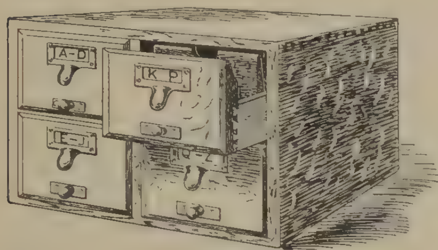


Fig. 254.—Card Index Cabinet

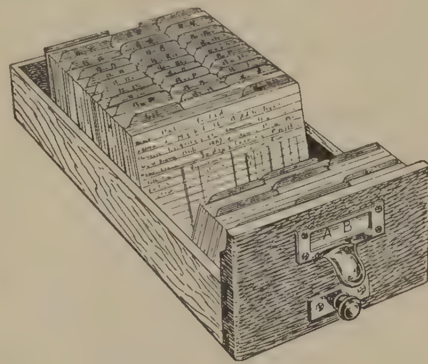


Fig. 255.—Drawer of Card Index Cabinet

filing systems are of the greatest use in filing correspondence, invoices, and other documents which may be required for reference, and can be easily adapted to meet special requirements.

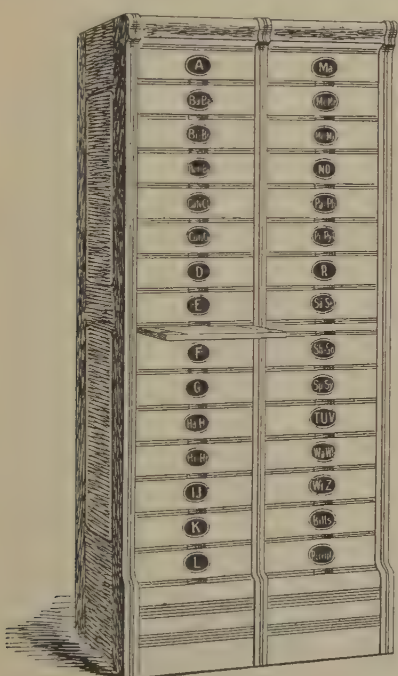


Fig. 256.—Flat Filing Cabinet

Card Index File.

The card index file (fig. 254) consists of a cabinet containing one or more drawers (fig. 255), each of which is furnished with a number of cards, specially ruled for the purpose for which they are to be utilized. Guide cards alphabetically or numerically labelled are placed between the other cards to facilitate the location and withdrawal of any particular card. The card system has been mentioned as being specially suitable for keeping the prime costs of material, labour, and stock.

In the flat filing system (fig. 256)

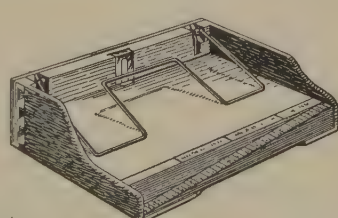


Fig. 257.—Drawer of Flat Filing Cabinet

Flat Filing System.

the number of files (fig. 257) required in the cabinet will depend upon the number of documents to be dealt with daily, and

should be about thirty where sixty papers per diem have to be filed. The number of files apportioned to each particular series of documents, which may be either the series of correspondence, invoices, orders, or petty cash receipts, &c., must be proportionate to the number of each of these papers received daily.

A single file (fig. 257) consists of a tray fitted with a removable thumb index, which is generally alphabetically arranged either in the simple alphabet or in combinations of letters, and can be obtained, prepared from most careful investigation by the makers, to meet practically any requirements. The documents to be filed are placed between the leaves of the index, without fixing in any way, the first letter or combination of letters of the name of the firm from whom the document was received corresponding with the letter or letters of the index. If two or more files are necessary to contain the documents, the index would be amplified and run through the series, commencing at the letter A in the first file, and finishing at the letter Z in the last. The contents of each file and the section of the index should be legibly recorded on the front of each file.

Fig. 258.—Vertical Filing Cabinet

Vertical Filing Cabinet.

The vertical filing cabinet (fig. 258) contains one or more drawers of sufficient width and depth to take the documents required to be filed without folding. For the purpose of general business correspondence, invoices, orders, &c., drawers taking foolscap papers are suitable. In the cabinets of standard size, sufficient space is provided in each drawer for filing about 5000 papers. Each drawer is provided with folders or covers, in which the documents are placed, each correspondent being allotted a number upon the first transaction, and all future correspondence being conducted under this reference number. A folder under the same number would be allotted in the drawer to the correspondent, and in this folder all his documents would be placed.

In a case where an undertaking is being carried out in which much correspondence is likely to arise, possibly with various firms, and it is desirable to bring it all together, this particular work would be allotted a number and folder, and all correspondence in connection with that work would be conducted under that number and consequently filed in the one folder. It is sometimes convenient to subdivide the correspondence in connection with a job into sections, either to particular firms or to parts of the work, so that the whole of the correspondence relating to a particular part or firm is available for immediate reference. This is provided for by

having several folders under the one number; each folder, in addition to bearing the general reference number, would bear the name of the firm or section of the work, as the case may be.

It is necessary to provide an alphabetical index to the folders, arranged under the card system (fig. 254), to facilitate reference to the number under which the documents relating to the firm or work are filed. In some instances it may be more suitable to the requirements to utilize the alphabetical in preference to the numerical index upon the folders.

It will be found advantageous to attach the carbon or press copies of replies to correspondence, and file them with the letters or subject matters to which they refer, so that a consecutive record of the transaction is contained in one folder. Telephone messages should be written on special slips with the date and hour of receipt inserted, and should be filed with the correspondence, and all telegrams received and carbon copies of all telegrams sent, should also be filed.

CHAPTER XI

WHEAT CONSUMPTION IN BRITAIN

British Wheat Requirements.

The population of the United Kingdom was returned at the census of 1901 at 41,450,000. In twenty years, that is when the last census was taken in 1921, the population had risen to 47,263,530. Assuming a consumption of 6 bus. of wheat per head, we have an annual breadstuffs requirements of 35½ million quarters. This estimate is fully confirmed by the present rate of our imports of wheat and of flour (reckoned at its equivalent in wheat). This large amount of breadstuffs has chiefly to be supplied by foreign countries, as our own production of wheat does not now average more than 6,500,000 qr., from which about 500,000 qr. must be deducted for seed wheat, while on an average of years there is a proportion of our home crop unsuited for breadmaking purposes; this is particularly the case in very wet seasons like 1903 and 1922. In good years there is no better wheat for biscuit or cake flour, but more than about 25 per cent cannot be safely used in bread flour. Before proceeding to consider the varied sources of our bread supply it may not be without interest to compare briefly the relative bread consumption of the United Kingdom with that of some other civilized countries.

Consumption of Breadstuffs in Germany and France.

Taking our neighbour France, with a population of somewhere about 43,000,000, we get a breadstuffs consumption of roughly 46,000,000 qr. per annum, as against 35½ million quarters to the 47,000,000 people in this country. The consumption of bread in Great Britain and in the United States is quite moderate as compared with the figures furnished by the two leading Continental lands,

namely France and Germany. According to the Fiscal Enquiry Blue-Book the average consumption of wheat and rye (reckoned in grain) per head of the population in Germany and France is 525 and 550 lb., as compared with 356 and 290 lb. in the United Kingdom and United States respectively. The proportion of rye eaten in Great Britain is small, namely 6 lb. per head, while in the United States it amounts to 20 lb., in Germany to 325 lb., and in France to 77 lb. per head. It is evident, therefore, that the consumption of wheat alone stands at 350, 274, 200, and 473 lb. in the United Kingdom, United States, Germany, and France respectively. The amount of wheaten bread consumed in America may seem small, but it must be remembered that to a certain extent maize competes with bread as an article of diet in that country, in the form, for instance, of corn-mush—a kind of porridge. The German consumption of wheat is comparatively small, but the balance is made up by rye. It would not be safe, however, to conclude that the 325 lb. of rye assigned to each native of the Fatherland are entirely consumed in the form of bread, because rye is there used for several industrial purposes.

Differences in Standard of Living.

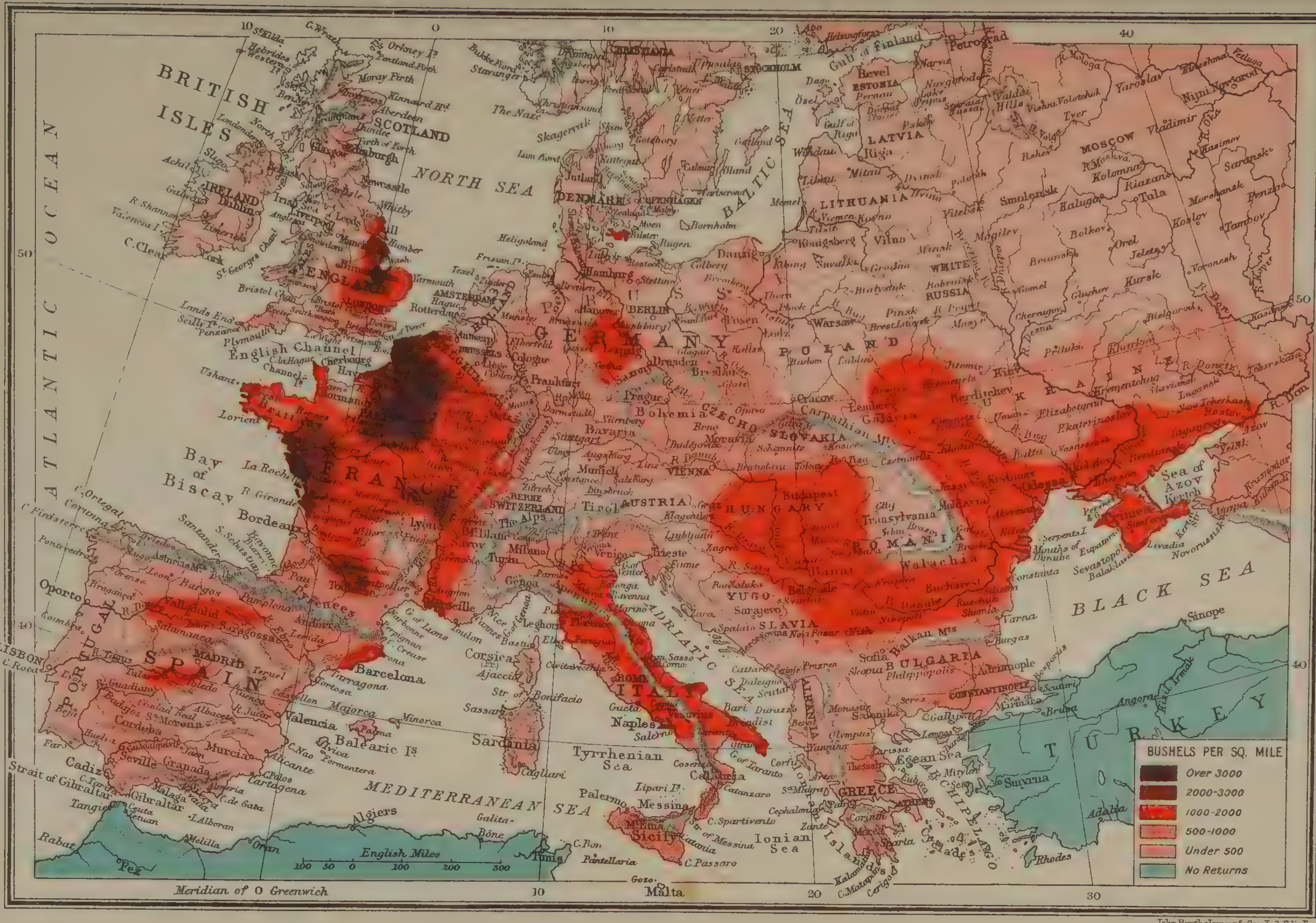
The wide difference between the bread consumption of this country and that of Germany and France is largely to be attributed to the higher standard of comfort enjoyed by the working classes of this land and of the United States. The more liberal wages enjoyed by British and American workers enable them to enjoy a comparatively generous diet. A table prepared a few years ago for the United States Commissioner of Labour showed that the average weekly expenditure of each family on meat, poultry, and fish in Great Britain, the United States, Germany, France, Switzerland, and Belgium worked out at 5*s.* 4*d.*, 5*s.* 4½*d.*, 1*s.* 11½*d.*, 2*s.* 2¾*d.*, 1*s.* 11*d.*, and 2*s.* 0½*d.* respectively. These are speaking figures, and fully explain the relatively small use of bread in this country.

CHAPTER XII

THE SOURCES OF OUR FLOUR SUPPLY

British Imports of Flour.

The United Kingdom has been a large importer of flour for half a century. As a matter of fact British flour imports were important, relatively to the consumptive capacity of the population, at an even earlier date. Going back to 1830, in the era of high protection, the total imports of flour into the United Kingdom were returned in that year as equal to 224,096 sacks of 280 lb.; in 1840 the flour imports amounted to 621,080 sacks. The repeal of the corn laws took effect in February, 1849, and in the following year our flour imports reached 1,542,016 sacks. The registration duty substituted by Sir Robert Peel for the heavy protective duties amounted to 1*s.* per quarter on wheat and 4½*d.*



THE CHIEF WHEAT-GROWING REGIONS

I—EUROPE

per cwt. on flour, equal to 11¼*d.* per sack of 280 lb. These duties were abolished in 1869. Through the fifties flour imports continued to increase, and in 1860 reached 2,055,696 sacks. At this point there was a lull in our flour imports, which lasted some years, and in 1870 they were actually less than in 1860 by 134,133 sacks. But from 1870 the flour imports of the United Kingdom began to grow rapidly. In that year the population amounted to some 31,500,000, while the total supply of breadstuffs was about 19,500,000 qr. (reckoning imported flour as wheat). The flour imports of that year were returned at 1,921,563 sacks. Taking calendar in place of cereal years, in 1873 these imports reached 2,484,960 sacks, and in 1878 3,131,231 sacks. The following year showed the great advance of 1,160,069 sacks on its predecessor, the total entries for 1879 being 4,291,300 sacks. For the 1870–9 decade the yearly average was 2,545,918 sacks. In the eighties the invasion of foreign flour made rapid progress. By 1882 the 5,000,000 mark had been considerably exceeded, while 1887 brought the then record figure of 7,225,293 sacks. The annual average for the 1880–9 decade was 5,862,636 sacks. The nineties were marked by bigger flour imports than ever. In 1892 the returns gave 8,842,503 sacks, but this year was eclipsed by 1899 with 9,178,280 sacks, which remains a record for any calendar year, though it was approached by 1901 with 9,029,000 sacks. The annual average for 1890–9 reached 7,859,087 sacks.

Growing Imports after 1870.

In thirty years the flour imports of the United Kingdom had about quadrupled. The explanation of this remarkable increase is simple. Early in the seventies the American north-west had been discovered by millers. That is to say, the magnificent quality, from a baker's point of view, of the hard spring wheat grown on the practically virgin soil of Minnesota and the Dakotas had become apparent, and the milling capital of Minneapolis had been founded. But as the mills grew in size there was a larger and larger surplus for which an outlet had to be found. This was secured in free-trading Great Britain. We shall presently show in figures how large has been the proportion of American flour imported into this country, but as an instance we may point to the cereal year from August 1, 1901, to July 31, 1902, which witnessed the record imports of 9,229,700 sacks of 280 lb. Of this enormous total not far from 8,000,000 sacks were of American origin. This was not all spring wheat flour from the north-western states of the Union; a small proportion came from the Pacific coast—flour more or less soft and white—while a more considerable percentage consisted of hard winter wheat flour from Kansas and other winter wheat states. But the fact remains that American millers have made their mark in this country chiefly by spring wheat flour. It has often been asserted, especially within the past few years, that American spring wheat flour has declined much in quality, as compared with the standard of the eighties and early nineties. This is a debatable point, on which we cannot enter for the moment, but it is obvious that the quality of all breeds of wheat is liable to vary from season

Why British Flour Imports Increased.

American Spring Wheat Flour.

to season. In 1904, for instance, there was a partial failure of the spring wheat crop, owing to the appearance of red and black rust in the Red River Valley and other parts of the north-west. Not only was the yield of wheat diminished, but its quality was seriously impaired. That strength, which had made Minneapolis and other American spring wheat flours so sought after by British bakers, had almost vanished. Naturally American millers in spring-wheat districts found it difficult to keep up any export trade at all. Probably under those difficult conditions the best results were achieved by one or two Minneapolis mills which took to grinding Manitoba wheat in bond. That is to say, they imported Canadian spring wheat to mill the flour for export; on the offals, of course, duty had to be paid if disposed of at home. The Canadian side of the Red River Valley, though it did not altogether escape the scourge of rust, suffered less than the American. The tale of this disastrous season is told by the imports of American flour into the United Kingdom from September 1, 1904, to August 31, 1905, namely 1,570,668 sacks of 280 lb., as compared with the same imports during the same period of 1903–4, which reached 5,149,556 sacks.

Canadian Wheat Ground in United States.

It is interesting to compare with these returns the flour imports during the calendar years 1903, 1904, and 1905, which amounted to 8.240,460, 5,889,157, and 4,781,905 sacks respectively. These figures include flour imports from all countries. The annual average for the six years 1900–5 works out at 7,585,967 sacks. In comparing the returns of flour imports for different years it is well to remember that prior to April 15, 1902, when Sir Michael Hicks Beach (afterwards Viscount St. Aldwyn) imposed the duty on corn and grain which his successor, Mr. Ritchie (afterwards Lord Ritchie), remitted in the budget of the following year, many kinds of wheat offals, such as sharps and middlings, were included in the custom-house returns under the heading of wheatmeal and flour. These are now separately distinguished. It would be interesting to have a classified return of all the imported flour, but perhaps this is asking too much of the custom house. Though offals pure and simple are no longer enumerated as flour, there is no doubt that a certain proportion of our flour imports consists of low-grade flours little better than offal. Such flours are imported from South Russia, Hungary, France, America, and elsewhere. They are used for making dog biscuits and for different kinds of animal food, but breadmaking flours they are not. It is difficult to say exactly what proportion of our flour imports consists of such low grades, but at times the proportion must be considerable. A custom-house official has estimated the percentage of non-breadmaking flours at 25, but this must be more or less conjectural.

Variation in Method of Customs Returns.

Low-Grade Flour in Imports.

Before the Great War there was a certain continuity in the matter of flour supplies. The principal sources of supply were the United States, particularly the North-West, Canada, Australia, Austria-Hungary, France, and, in very small quantities, Germany

Sources of Flour Supplies.

and Holland. During the war period flour supplies were received from all sorts of odd corners, the principal sources, however, being still America and Canada and Australia, but a considerable quantity was obtained from China and Japan. The Chinese flour had rather a bad reputation for a time, but when the information was available, after the war period, that it had been bought in large quantities and not at once distributed, but stored as a reserve, in many cases in places quite unsuited for flour storage and receiving the minimum of attention, then bakers began to wonder whether the vagaries of the Chinese article were due to any inherent defect or to improper treatment after it had been made into flour. On comparing notes it was discovered that some of this stuff was quite satisfactory and those who got the good article were eager searchers after more on account of its nice colour, but no reliance could be placed on new deliveries, and as the Government was the only merchant—millers and factors merely acting as Government agents in the transactions—there was no redress if a parcel turned out a bad lot. During a part of the war period millers were instructed by the Wheat Commission to use a proportion of this Chinese flour in their grists instead of grinding an equivalent quantity of wheat, and such mixture made extremely poor flour.

Growing Imports of Canadian Flour.

It will be evident that with all set-backs and the opening of new sources of supply, the United States retains the lead in the exports of flour to Great Britain, other countries being, so to speak, nowhere. Canada is a bad second, but is making much progress within the last few years. It is probable that our actual imports of flour milled in Canadian mills are larger than indicated in import tables. The customs returns identify all goods by the port of shipment, and though of late special blue-books have been issued, which try to trace the land whence our imports were consigned, the data do not yet seem to be altogether certain. A sensible amount of Canadian flour must reach us from American Atlantic ports, and no doubt some American flour is shipped from Canadian ports. The bulk of the Canadian flour we get is from Manitoba. It is milled from a spring wheat practically identical with the raw material of the esteemed patents of Minneapolis and Duluth. As the area under wheat in the Canadian north-west extends we may expect even more liberal supplies of flour from the Dominion. An effort is being made by the large Canadian mills to send flour of a slightly softer character than that made wholly from Manitoba wheat, and this flour is finding a good deal of favour amongst English bakers. The fermenting process is comparatively short, and excessively tough flours like those made wholly from the hardest winter wheats do not seem to blend readily with home-milled flour either of the comparatively strong sort made by the Port millers or with country flour which is extensively bought by bakers who do their own blending. The Canadian flour now sent here has a character a little stronger than the same grade of Kansas, but not quite so tough as the best sorts of Minnesota. It appears that in Canadian wheat-growing districts there is now a good deal of Durum wheat grown, and if a fair proportion of

this is milled along with the much stronger varieties indigenous to the Canadian wheat districts, the flour will be softened to the extent that it will lose some of its toughness but without becoming in any way runny. Flour containing a proportion of Durum wheat is also likely to yield well in bread, owing to its water-absorbing properties, and the resulting bread is likely to have a good bloom. The quantity of flour imported from Canada is about a million sacks per annum, while we still receive about three and a half times as much from United States ports.

We have had no flour from Hungary (Budapest) since 1914. This flour occupied the leading place for many years, and was in particular favour in Glasgow and Scotland generally. But the sales had declined considerably before 1914, less because of reduction in quality of the Hungarian, as because of the high quality of home-milled flour of the top grade.

French Flour.

French flour finds a moderate sale in some British ports, but this trade could hardly expand much unless British farmers altogether gave up the culture of wheat. French flour is a substitute for English country flour, with which it can compete when the price is favourable. It is noteworthy that some fifty years ago our imports of French flour were relatively large, and in those days Spain, a country from which for several years not a single sack has been imported, was a regular exporter here. Supplies of French flour are intermittent, varying in normal times by four hundred thousand sacks per annum; they stopped in 1914 and have not restarted yet (1923). There was a revival in the nineties of the French flour trade with this country, which was largely due to the disguised bounty given to French port millers by drawback regulations. When the duty on imported wheat was raised in 1892 to 12*s.* 3*d.* per quarter of 480 lb., a drawback or rebate was granted to millers importing wheat to grind in bond. Originally a miller could import wheat, and by exporting 60 per cent of flour practically escape the duty, the 6*d.* he paid on his offals being a nominal sum. This arrangement gave him, moreover, at least 10 per cent of more or less saleable flour duty free, because 70 and not 60 per cent is a fair yield of flour from wheat. But in 1896 the French Government, acting under the pressure of the powerful agricultural group in the Chambers—it must not be forgotten that nearly half the population of France is interested directly or indirectly in wheat-growing—began to limit in various directions the facilities granted to exporting millers, and it is a question whether the drawback as now regulated gives millers any bounty at all. But probably whenever France grows a more than usually abundant crop we may expect fair imports of French flour.

Spanish Flour Imported.

Effects of Drawbacks on Exports.

German Flour Imported.

Germany was a regular exporter of flour to this country for many years, and Hamburg was at one time, in stone-mill days, one of the principal sources of foreign flour supplies. Since 1914 we have of course imported no flour from Germany, and the indications are that we are more likely to be exporters to that country.

On the other hand, several lands have within the past few years given

signs of desiring to cultivate a trade in flour with this country. Three of the Australian colonies, namely New South Wales, Victoria, and South Australia, have become more or less regular exporters of flour here. In 1901 we received 218,684 sacks from those three colonies. This was due to the good crop of 1900. The following year was below the mark, and our Australian flour imports fell to 12,170 sacks. In 1902 there was a crop failure, the result being that our imports dropped to 8 sacks of flour from New South Wales. But with the bountiful crops of 1903 and 1904 the flour trade revived, and in the calendar years 1904 and 1905 we imported 310,116 and 393,520 sacks respectively of Australian flour. The future of this trade must depend to a great extent on the seasons in Australia, which are somewhat uncertain. Australian wheat is the direct descendant of seed obtained originally from Austria and Roumania, but, as frequently happens when seed is taken to new soil and new climate, it has "sported", a word used in agriculture to denote a distinctive change in character. Australian wheats have now properties peculiar to them, but only in a very slight degree like the original seed. Thus, flour made from South Australian wheat is according to any standard strong flour, in character not unlike flour from what is known as Kansas hard winter wheat, and used alone makes bulky bread of mellow nature and good flavour. Flour made in Victoria is considerably softer and may rightly be compared with red winter wheat sorts but a little stronger. New South Wales wheats make, as a rule, very soft flour, but within the last ten years harder sorts are being cultivated. A large proportion of the Australian flour imported into Great Britain is from New South Wales. During the war the British Government bought the whole exportable surplus of Australian wheat and flour for the whole war period and to the end of 1920. A good deal of waste accrued on account of unsatisfactory storage.

Australian Flour Imports.

Effects of Drought on Australian Flour Imports.

Nature of Australian Flour.

Argentine flour has been known in our markets for several years. At first the imports consisted almost exclusively of low grades. Presently patents came along, and in recent years arrivals have assumed a certain importance. Up to now, however, the Argentine flour trade has proved somewhat disappointing. Buyers have complained of irregular quality in marks for which a good price had been paid; it is a curious fact that better value has often been got out of the lower than the higher grades of Argentines. Those who have handled La Plata flour allege a difficulty in gauging its baking colour from the Pekar test. This flour has often some degree of strength, but in this, as in other respects, is variable.

Poor Quality of Argentine Flour.

Belgium in pre-war days sent us a fair amount of flour, her average over a period of five years being about 125,251 sacks. This flour was not very strong, approximating in character to that from Winter wheat Kansas. Belgium possessed many well-equipped mills, and in normal times, particularly if prices are high here,

Belgian Flour.

is able profitably to send us flour. Wheat is admitted free into Belgium but a duty about equal to 2*s.* per 280 lb. sack is imposed on flour.

Dutch Flour.

Holland ships flour on a moderate scale to this country, the average reaching about 22,246 sacks. Dutch flour, like that made by home millers, is wholly from imported wheat, and the flour sent here is in character very like ordinary patent grade from a port mill.

Italian Flour.

Another small exporter is Italy, but during the war supplies wholly stopped, and under post-war conditions are not likely to appear in the English market.

Russian Flour.

At one time an effort was made to develop a Russian flour trade here. The exporting mills were situated in Odessa. Flour of all grades was imported; the effort was made to compete with Hungarian flour from Budapest. The top patents were for their class of excellent quality: stronger than Hungarian, but with the same high water-absorbing capacity and the same stodginess which made it impossible to get large bread from it.

Roumanian Flour.

Roumania now raises on an average more wheat than she can consume, and in such ports as Braila and Galatz there are a few well-equipped mills which cultivate an export trade. But here again supplies to Britain have stopped since 1914. Roumanian flour is made from wheat like Hungarian, but the millers in the latter country make much better flour.

Danish Flour.

Years ago Denmark used to be a regular, if moderate, exporter of flour to Great Britain, but our imports from this source had become insignificant.

Chinese Flour.

Reference has already been made to the use of Chinese flour during the war, but it is quite on the cards that both China and Japan may become sources of flour supplies in peace time. In both countries the wheat-growing areas are being much increased, and there are well-equipped mills of both English and American design. The people are so careful and the Japanese so enterprising that an invasion of flour from that country is a likely enough event.

Indian Flour.

British India has exported some flour to this country. These imports are included by the Board of Trade under the heading "Other British Possessions", but it is probable that flour entered under this heading was largely milled in British India. In the great ports of that land are many well-fitted merchant mills, which at times are bound to have some surplus for export. The flours imported from India have evidently been made from carefully selected wheats, such as millers in this country could not readily procure.

Decreasing Flour Imports.

In reviewing the growth of foreign flour imports into this country, it is evident that though the proportion of flour of foreign origin consumed in the United Kingdom is large, it is apparently on the decrease. Commencing with 1880, when the flour imports rose to nearly four million and a quarter sacks, the then population of rather less than 35,000,000 was estimated to consume over 31,000,000 sacks of 280 lb.

per annum. The consumption of foreign flour was then between 13 and 14 per cent of the total requirements. From this time the percentage increased rapidly. It was fully 20 per cent in 1883, and though it decreased a little during the three following years it had nearly reached 22 per cent in 1887, a year of heavy American imports. From this date there was a certain decline till 1892, when the 22-per-cent mark was exceeded, and in the succeeding year 23 per cent was reached and passed. In the course of the next five years the percentage fluctuated but never fell below 20, and was often well above 23. In 1899 it was fully equal to 25. In the first two years of the nineties it hung round 23 and 24, but dropped rapidly from 1902, descending in 1904 and 1905 first to 15 and then to somewhat over 12 per cent, where it stands at present. It must be remembered that the heavy imports of foreign flour which checked the expansion of British milling from 1898 to 1901 were almost entirely due to big surpluses in America, which allowed merchant millers in that country to flood our markets with cheap but excellent flour. Such conditions may not recur, but they may. At present the drift of social and economic factors in the United States does not favour big flour shipments here. For one thing, American millers are finding other markets than in Europe; still, a big crop is always possible in America. Moreover, Canada is increasing her wheat acreage in the far west by leaps and bounds, and the time will surely come when mills in the Canadian north-west will be driven to seek outlets for their surplus flour in this country. Flour milled from the hard spring wheat of Manitoba, Alberta, or Saskatchewan is bound to find a ready sale in this market, provided the price be reasonable.

Growth of Milling Capacity in Britain.

It is said, and with perfect truth, that the millers of this country have within recent years considerably increased their milling capacity, and it is argued that firms which have laid out scores of thousands of pounds in extending their milling capacity cannot afford to allow foreign flour to invade this market. It is perfectly true that since 1903 the milling capacity of the United Kingdom has been largely increased. These extensions consist chiefly in enlargements of the capacity of big port mills and in the erection of some new port mills. The enterprise shown in these undertakings was due partly to the indifferent harvests in America in 1903 and 1904. The fruits of this over-extension of capacity may be seen to-day in the fierce fight which the ports mills are waging among each other and against all their smaller competitors. During the war period British mills were all under Government control and competition stopped. Since control was relinquished the large mills have formed themselves into groups and competition between the groups is adjusted very carefully, and prices and conditions are much alike. The big mills at the ports can make flour cheaper than the inland mills, and are better equipped to deal with almost any kind of wheat which may come on the market. But if the capacity of the large port mills were even bigger than it is, that would not prevent American, Canadian, and Australian millers sending flour to this country, if they could only get

wheat cheap enough to enable them to underbid the British miller. The only advantage the British miller has to-day over his American competitor, which his predecessor of the eighties and nineties did not possess, is this, that the present surplus of Manitoba wheat is large enough to leave sufficient for export. Thus the London or Liverpool miller can get at a reasonable price raw material equal to that enjoyed by his competitor in Minneapolis. Of course as mills grow in Canada the local competition for wheat will increase, and the price of Manitoba wheat in our markets will tend to rise. Russian wheat being now out of the market, great reliance has had to be placed on supplies from Argentina and other South American States and on India. Minnesota and the two Dakotas might reap a bumper crop, while again the harvest in Manitoba and the Canadian north-west might be a partial failure owing to early frosts. Australian wheat supplies are always uncertain. In such a case the British port mills would be bound to meet severe American competition, no matter what their own capacity might be. Of course we are assuming that this country adheres to free trade.

Cheap Wheat in British Ports.

Possible Return of American Competition.

CHAPTER XIII

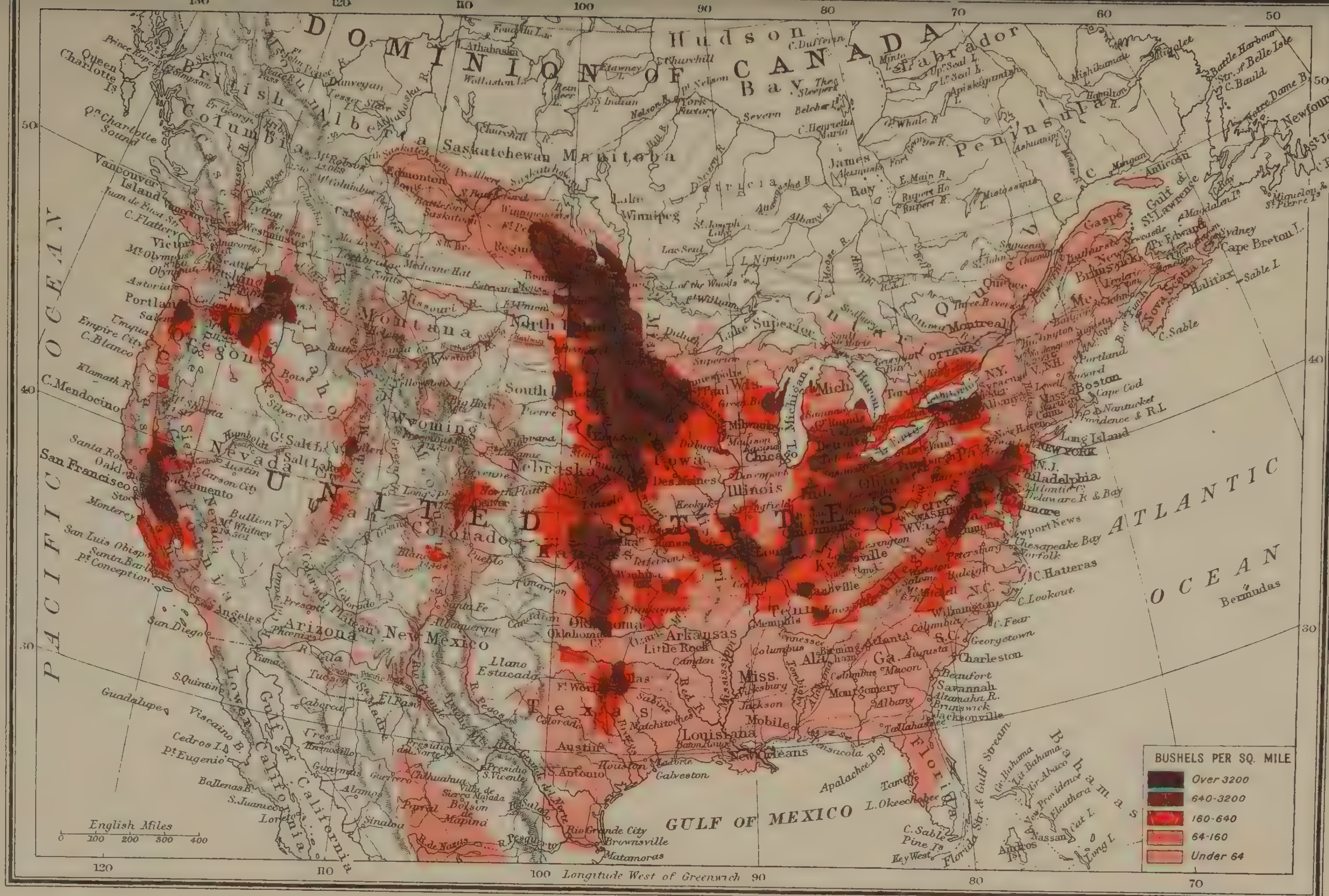
HOW TO READ THE MARKET

Everyone who is interested in either wheat or flour tries to read the market; in other words, he is anxious to gauge the probable trend of the market from such indications as are to hand in the shape of crop estimates, statistics of wheat reserves, shipping activity, and so forth. This is an age in which everyone tries to get forward, and read the future course of events. The turf prophet is not without honour among people of a certain order of intelligence, though it must be confessed he has very slender data on which to base his vaticinations. In the case of wheat we have fortunately more ample sources of information, and can predict more or less accurately the course of the markets from a careful study of statistics and other factors. In this country there are three journals exclusively devoted to interpreting the wheat and flour markets. In these papers the world's shipments are chronicled day by day, while the state of stocks the world over is likewise noted, so far as such information can be ascertained. The progress and prospects of crops, with the results of harvests, are of course noted, while all important grain markets are duly reported. The periodical review of the market given by one at least of these papers is very luminous; but perhaps the most valuable information published by these journals consists of the statistics, which are generally accurate, and furnish a key to what is called the statistical position of wheat.

Market Forecasts.

Wheat and Flour Market Journals.

To anyone engaged in dealing day by day in wheat or flour these



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journals are of value, but their perusal would take too much time from the day of the hard-working baker. It does not follow, however, that the user of flour cannot read the market within wide limits by noting and observing certain landmarks, so to speak. Prices are, of course, fixed by the relation of supply to demand. Hence the extreme importance of ascertaining the statistical position of wheat as closely as possible. For instance, if it should happen that the United States and Canada had both big crops in the same year in which Argentina and Australia have good harvests, it would be a safe guess that a cheap cereal year was before us, because an exportable surplus of say 40,000,000 qr. from those lands would be sure to be supplemented by some 10,000,000 to 20,000,000 qr. from other sources, such as Argentina, Australia, India, &c. An exportable surplus of 65,000,000 qr. would probable be sufficient to bring down the price of wheat below the normal level, though we must not forget that the consumers of wheat are always growing in numbers. In the spring of 1894 the throwing on the European markets of the Argentine surplus of about 7,400,000 qr. sufficed to bring the value of wheat in the open markets of this country to a 20*s.* level. But it must be borne in mind that in that season America's wheat exports were heavy, amounting to 20,375,000 qr., while Russia shipped in the same cereal year 13,500,000 qr. In those days the needs of the importing countries ran around 50,000,000 qr. per season. It is exceptional for big crops to be raised all over the world in one and the same season; that the United States and Canada, Russia and Roumania, La Plata, Australasia, and India should all bear heavy crops in one season is most unlikely, though it may be possible. The meteorological conditions which exert so powerful an influence on crops are apt to vary widely from one quarter of the globe to the other; hence a poor crop in such a land as Russia in Europe is likely to be balanced by a good harvest in the United States. In 1891–2 Russia was in the throes of famine, owing to the failure of the crops in eighteen governments or provinces of European Russia, some of which are normally among the most productive of Russian wheatfields. Ultimately the Russian government was compelled to prohibit the export of wheat by imperial edict. During that cereal year the United States shipped in wheat and flour some 28,000,000 qr., while India—an uncertain shipper—exported 7,500,000 qr. On the other hand, one is almost afraid to think of the level to which wheat might have risen during the 1903–4 and 1904–5 cereal years, had not Russia and India come to the rescue and supplemented the serious falling off in American shipments, especially during the 1904–5 season. Thus does nature tend to redress the deficiency of a harvest in one country by abundance in another.

Statistical Position of Wheat.

Compensations in Harvests.

Russian Government stops Exports.

Russia and India to the Rescue.

In estimating the value of different exporting lands as factors in the statistical problem, it is important to bear in mind the different seasons at which their respective crops are gathered. Harvesting is going on all the year round in some parts of the world

United States Harvests.

Argentine Harvest.

For instance, in the United States the winter wheat crop is normally reaped in June and July, while the spring wheat is harvested in August; if late, in early September. The Argentine crop is cut in December, so also is the Australian; while in New Zealand wheat is harvested in January. The Indian wheat harvest is got in in February, March, and April, according to the latitude. The French harvest commences in the south late in June, and proceeds throughout July, the northern departments not completing the harvest till August. In Austria-Hungary harvesting is normally in full swing in July, while in Russia cutting commences in the south in July and proceeds throughout August in the central provinces and Poland; not till October is harvest completed in the northernmost governments of European Russia.

New Zealand Harvest.

Indian Harvest.

French Harvests.

Austro-Hungarian Harvests.

Russian Harvests.

It is also well to note at what times the wheat of different lands begins to reach our markets. For instance, Plate wheats usually arrive from March onwards, Australians in April, Bombay shipments in June, Kurrachee in July, while American and South Russian winter wheat may reach us from the end of July right through August. South Russian spring wheats and Roumanian wheat usually begin to arrive freely in September, while October will bring us American spring wheat (when any is being shipped), and November will witness the arrival of Manitobas and wheat from the other north-western provinces of the Dominion whenever there is anything like a surplus for export. With regard to flour, that follows broadly on the same lines as wheat, but is naturally later in reaching us, and is sometimes subject to considerable delay. For instance, spring wheat flour from Minnesota, in the American north-west, might after a fairly good crop be expected to begin arriving in London, Liverpool, or Glasgow, from the third week of October onwards; on one occasion a good deal of such flour was expected in London by the end of October, but it made no appearance, and even at the end of November was only arriving in driblets. Not till the beginning of the year did American spring wheat flour begin to reach London freely, and then it came like an avalanche. Early in January American flour began to arrive at the rate of 40,000 sacks per week, and one and the same boat would contain parcels bought on August, September, and October bills of lading. Obviously there had been great delay somewhere in forwarding this flour; probably a good deal of it had been lying in warehouses in American Atlantic ports waiting for low freights. Winter wheat flour may begin to reach this country in August, but is not usually much in evidence till September. Australian new-crop flour will not arrive much before March, April, or May. The first Argentine flour may reach us in March.

Times of Importing Different Wheats.

Arrival of Spring Wheat Flour from America.

September Arrivals of Flour.

April and May Arrivals.

In reading the market it is essential to bear in mind that prices are determined largely by the supplies of a few exporting lands. The value

of wheat is determined in the last resort not by Chicago, but by the prices bid by buyers in the open markets of Liverpool, London, and Antwerp. The influence of duties upon wheat and flour is purely local; if a merchant in London or Antwerp is willing to bid 31*s.* c.i.f. for a cargo of Californian wheat, a buyer in Dunkirk will have to pay the same price plus the French duty, 12*s.* 2*d.* per qr. of 480 lb., or 43*s.* 3*d.* in all. The crops of the exporting lands are therefore of the utmost importance to all interested in wheat and flour.

The Price of Wheat.

It may be noted that while the European consumption of breadstuffs nas increased very considerably during the past decade, so has supply steadily grown, chiefly through the spread of wheat culture in such lands of virgin soil as La Plata, Canada, and to some extent Australia. It will be convenient to bear in mind the chief lands from which European supplies are drawn, because these countries and their statistical positions are always essential factors in the market or price problem. Into the history of the parts played by these lands it is not necessary to enter here, because that has been reviewed in the chapter on "The Sources of our Flour Supply". But it should be kept steadily in mind that the United States and Canada, Argentina, India, Australasia, Russia, and Roumania are all exporting lands of more or less importance.

Increase of Wheat Supplies.

Great Supply Sources.

To read the market with any hope of success we must take into account all kinds of factors; above all we must be chary of drawing conclusions from a few salient features of the market. For instance, while the floating stock, as the wheat afloat and headed for this country and the Continent is currently termed, is undoubtedly a most important item, its bearing on the market must not be estimated merely from its size, because out of 4,500,000 qr. afloat 2,500,000 qr. might be very distant from our shores, having been despatched from Australian and Californian ports. The floating stocks exercise the more influence on the market the nearer they are to the ports of consumption, which is of course only natural. One of the corn-trade journals which busy themselves with the collection of grain statistics makes a point of analysing the sources of the floating supply. But the mere knowledge of the actual amount of wheat afloat and headed for Europe is not all in all; beyond this one needs to get some idea of how demand is likely to vary. This country with its 47,000,000 people, and its relatively small production of wheat, is necessarily a big customer for wheat—probably in a normal year our demand for foreign wheat (and flour reckoned as wheat) could not now be put much under 35,000,000 qr.—but Great Britain and Ireland cannot absorb all the surplus of the exporting lands, and given liberal exports the market is usually strong or weak in proportion to the assistance rendered to Great Britain, the premier consumer of foreign wheat, by the Continent of Europe. This varies a good deal.

Floating Cargoes as Price Factors.

Influence on Markets of British Demands.

With the exception of Holland and Denmark, free-trading lands, and

of Belgium and Switzerland, the former admitting wheat free and the latter levying a duty of 6*d.* per quarter of 480 lb., almost all Continental countries of set purpose hinder the import of wheat by high tariffs. The object is, no doubt, to encourage as much as may be the home growth of wheat, but the practical effect is to check imports of wheat unless most urgently needed. In spite of these artificial barriers the Continent is in the aggregate a considerable importer of wheat, and at times a bad crop—as in France in 1897, and in Germany in 1905—will cause heavy imports. In France the duty of 12*s.* 2*d.* per quarter was entirely suspended from May 4 to July 1, 1898, and millions of quarters poured in. Germany, with a poor crop in 1905 both of wheat and rye—at any rate as far as quality was concerned—imported about 7½ million qr. of wheat between the 1st August, 1905, and the 28th February, 1906, in spite of a duty of 7*s.* 6*d.* per quarter of 480 lb. On the 1st March the new duties came into force, the minimum due on wheat being brought up to some 12*s.* per quarter, but still imports proceeded.

Effect of Tariffs.

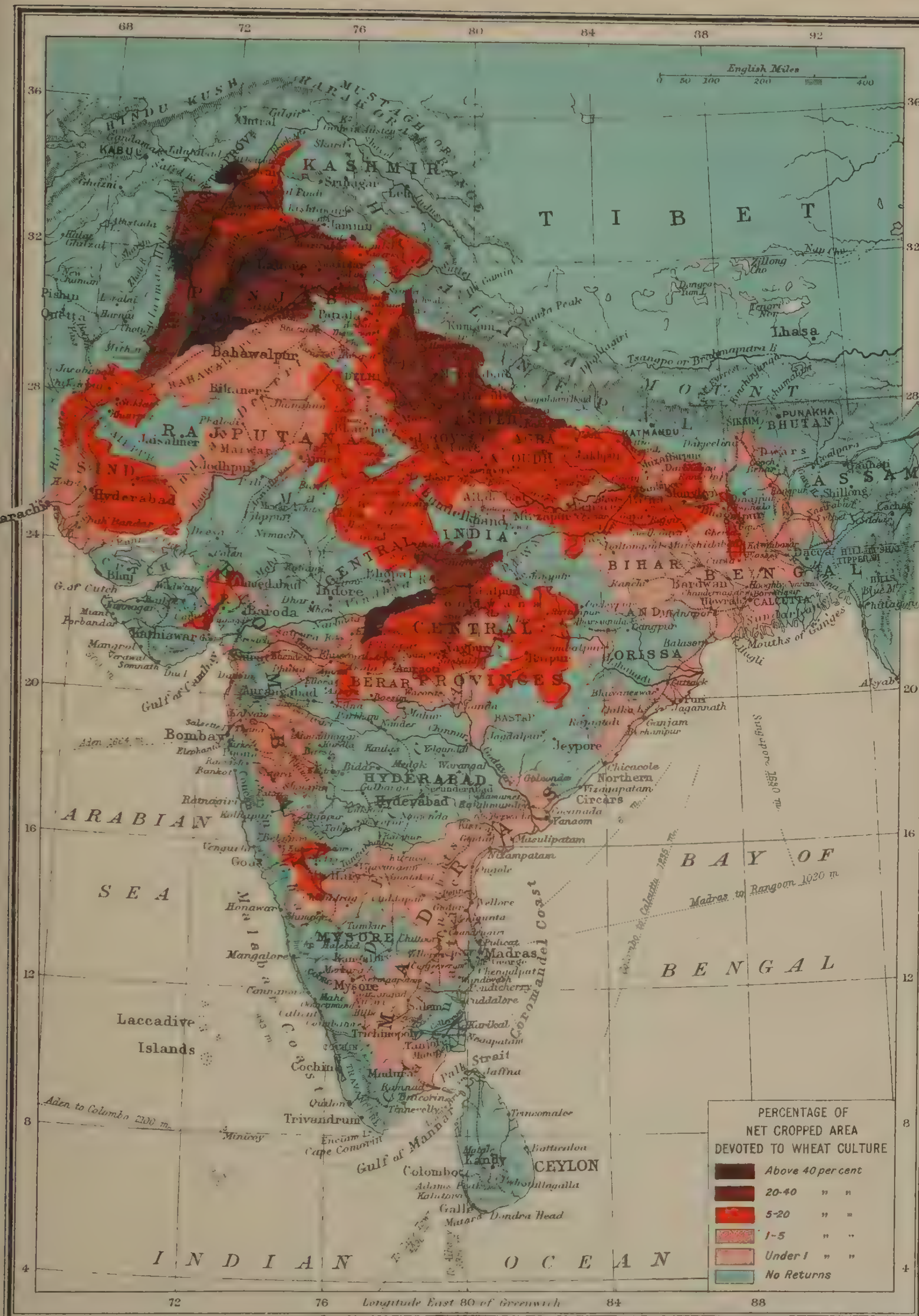
Intermittent Continental Demands.

It is easy to see how important a factor is Continental demand in the price problem. In a general way France has become self-sufficing so far as wheat is concerned, her imports in some recent years having been confined to a few hundred thousand quarters (including flour reckoned as wheat); but France is certain to have a crop failure now and again, and then she is perforce an importer. Germany, in spite of her almost frantic endeavours to stimulate wheat production, is bound to be an importer of wheat, more or less. Up to about 1890 Germany imported only some 3,000,000 qr. of wheat for her own consumption, but since then the demand for wheaten bread has been increasing steadily, and the imports of 1896–1903 averaged between 7,000,000 and 8,000,000 quarters per annum. The present average needs of Germany cannot be far short of 20,000,000 qr. per annum. For some reason or other the working classes in the Fatherland seem to be losing their taste for rye bread, or perhaps it would be more correct to say that the demand for wheaten bread was extending into quarters in which it was previously unknown until war conditions prevailed.

Continental Imports.

In this connection it should not be forgotten that the cereal rye is an important factor in the formation of prices, and that in spite of the fact that in this country rye flour only meets the smallest demand in the Jewish quarters of a few great cities. Germany raises some 42,000,000 qr. of rye as compared with 18,000,000 qr. of wheat. In Austria-Hungary the production of rye (and spelt) is, striking an average, as about 15,000,000 qr. to 25,500,000 qr. of wheat. In European Russia the mean production of wheat is about 40,000,000 qr. to 85,000,000 qr. of rye; while in Russian Poland, where not more than about 2,000,000 qr. of wheat is raised, at least three times that amount of rye is grown. In the Scandinavian countries, again (Sweden, Norway, and Denmark), the production of rye greatly exceeds that of wheat. It

Effects of Rye on Wheat Prices.



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is clear, then, that a failure of the rye crop in such a country as Germany or Russia would seriously affect the balance of the international corn trade. If Germany reaped a short crop of rye, she would inevitably have to import more wheat; if the shortage occurred in Russia, the exportable surplus of wheat would be lessened, because the Russian peasantry largely depend on rye for their daily bread; wheat, being more or less saleable in European markets, is in normal times an article of export, though Russia is also an exporter of rye to the amount of 5,000,000 to 6,000,000 quarters per annum. In taking into consideration the Continental demand, an important factor is the condition in which grain is gathered. A really wet harvest in France or Germany would mean the importation of a sensible quantity of dry foreign grain to mix with the damp wheat or rye, as the case might be—unless, indeed, there happened to be a large stock of dry grain left over from the preceding harvest.

Visible Supply.

It is evident that the factors which influence the market are more complex than might appear at first sight. As prices are undoubtedly governed by the relation of supply to demand, statistics of stocks of all kinds are always in request among students of the market. It is for this reason that the condition of the American "visible supply" is cabled over daily from the other side of the Atlantic. With regard to this visible supply, the most trustworthy version is that collected and published by Bradstreet's agency. This is said to be made up from returns received from upwards of 1000 different points. Briefly, this return covers the stocks in public elevators in the United States and in Canada east of the Rocky Mountains; in other words, this is the visible supply as contrasted with the invisible supply in farmers' hands. This stock varies with the abundance or otherwise of wheat, and also with the season of the year. As the cereal, or, to use the American phrase, the crop year draws to its close in June, the stocks in public elevators run down, and after a year of a short crop get very low indeed. As soon as the winter wheat is gathered—and in the south-west a great deal of wheat has been cut by the middle of July—the farmers begin to deliver at primary points, or country elevator towns, whence the wheat makes its way in due course to the terminal elevators at such places as St. Louis, Chicago, Milwaukee, and others. The word elevator is here used in its American sense of a grain warehouse. This is not the place to discuss the American elevator system. Suffice it to say that the elevator and railway companies of America, whatever their exact financial relations may be, are in a sense twin brothers. But for the elevators, which act as magnets in drawing wheat, the railroads, with their mileage running into hundreds of thousands of miles, could never have rendered such enormous services to the American farmer.

Bradstreet.

Movements of Wheat in America.

The American Elevators.

The importance of the visible supply as a factor in the statistical

position needs no demonstration. But it would also be easy to exaggerate it. This item in the world's cereal statistics is often accepted as an infallible index to the size of the United States crop of wheat, but this is not the case.

Visible Supply not a Complete Guide to Stocks.

At least the visible supply can only be taken as a guide to the crop with reservations and qualifications. No doubt a liberal and well-sustained flow of wheat at primary points is *prima facie* evidence of a liberal crop, but the price the farmer is receiving must be closely examined. A good price will often draw wheat out of all proportion to the size of the crop.

Effects of Good Prices on Visible Supply.

For instance, a poor Russian harvest synchronizing with a failure of the Indian crop would be certain to raise prices to a high level, especially in the absence of large crops in Germany and Central Europe. Under such conditions American farmers would be likely to become free sellers, and for a time the pressure of supplies might bring down prices. This, in an ordinary way, would tend to reduce deliveries. Supposing, however, the Argentine crop gave a brilliant promise, while cheerful cables were to hand from Australasia, the American holder would probably keep on pushing his wheat into the market, because he will argue that it is better to get 80 cents a bushel for his wheat than keep it till free shipments from Argentina have knocked down wheat values to 72 cents.

In one interesting case on record Bradstreet's reported the visible supply east of the Rockies at 7,875,000 qr., as compared with 5,491,000 qr. and 6,030,000 qr. at the same period in two preceding years respectively. For this time of the year the visible supply in question—equal, namely, to nearly 8,000,000 qr.—was a respectable figure. Yet the exports of wheat from the United States remained on the moderate scale of something under 300,000 qr. per week; this total included, moreover, a considerable proportion of Manitoba (Canadian) wheat and of American flour, which is statistically reckoned as wheat. It is worth noting that when America is shipping only on a moderate scale, a large proportion of her shipments is apt to go in the form of flour. The official figures for the 8 months ended February of the lean year showed an exportation from all the United States of 4,157,218 qr.; of this no less than $87\frac{1}{3}$ per cent went in the shape of flour.

Interpreting Official Figures.

During the same period of a fat year the exports amounted to 8,894,429 qr. In this case the percentage exported as flour was only $61\frac{2}{3}$ per cent. The explanation of the overwhelming proportion of flour exports, when the total volume of shipments was so small, is simple enough. Wheat was no longer on an export basis. That is to say, it could not compete with Russian or Plate wheats in the markets of Europe. A poor crop (quantitatively and qualitatively) had raised American wheat to a level which, with carriage and freightage added, would have brought No. 1 Northern Duluth to many shillings above No. 1 Northern Manitoba. It may be asked how the American miller can export flour when wheat is no longer on an export basis. The answer is, that the American miller

holds so much to his connection in Europe that in times of wheat stringency he will ship flour without profit, or even at some loss, rather than lose all touch with the European market. With regard to selling at a loss, it is not probable that the American miller is more given to this practice than any other member of the craft. He can to some extent recoup himself by higher prices in his own markets. The amount of patent flour shipped from American Atlantic ports during the bad season was very small, and doubtless would have been still less but for the fact that one or two of the biggest Minneapolis mills were able to import Manitoba and Canadian spring wheat and mill it in bond. The bulk of the American spring wheat flour sent over here during that season was of the bakers' grade known in America as "clears".

Why American Millers can Export Flour from Dear Wheat.

Returning to the visible supply and its value as an index of the statistical position, it might seem strange at first blush that with first-hand stocks of nearly 8,000,000 qr., next to no American wheat was being shipped. It was the more remarkable, because the level of No. 1 Northern Duluth and of No. 1 Northern Manitoba was very nearly the same for some little time. But the explanation no doubt is this, that a better market for wheat is always to hand at Minneapolis and Duluth than at Winnipeg. The enormous milling capacity of Minneapolis, well in excess of 300,000 sacks of 280 lb. per week, is naturally loath to let wheat go which its mills can grind into saleable flour. The fixed salaries and the overhead expenses of these enormous milling plants make it more wasteful to let the work stop than to keep up the manufacture of flour even if that has to be done without profit or on the balance showing a small loss. Thus the distribution of the visible supply is an item of some significance as well as its total size. Besides the American visible supply, with the state of stocks on the Pacific coast of America, which is reckoned separately from the supply east of the Rockies, the student of the market is interested in the visible supply in Argentina, which consists of returns of wheat in the port elevators, and granaries at railway terminal points; in the Russian and Roumanian port stocks; in port or first-hand stocks in the United Kingdom, at Antwerp and Rotterdam, and generally in all great centres of the grain and milling trades, as, for instance, at Budapest.

Distribution of Visible Supply.

Visible Supply in Argentina.

Hitherto we have been speaking only of first-hand stocks, but it must also be remembered that second-hand breadstuff stocks, or those in the hands of millers and bakers, also count. These are naturally much harder to estimate; but, speaking generally, it is safe to say that within the past few years the grain-carrying capacity of British mills has considerably increased. While the number of flour mills worth taking into account in this country has steadily decreased, the capacity of the port mills has been very sensibly increased, and at the same time the warehousing accommodation has been enlarged by the erection or expansion of silo houses. One effect of this movement has no doubt been to reduce the size of first-hand stocks.

CHAPTER XIV

CROP ESTIMATES

Estimates of crops are necessarily of the greatest interest to all concerned in market movements. Unfortunately all estimates are not by any means of equal value. Official figures are often the least trustworthy. Until recent years the estimates of the Washington Department of Agriculture were far from meeting with universal acceptance; they were held by the best commercial authorities to err in the direction of underestimation. It is certain that in the nineties the movement of crops to market often falsified the Bureau's estimates. Of late years a different basis for crop estimation has been adopted, and nowadays the official figures may be accepted as approximately correct estimates of the United States crop. In a general way all official preliminary crop estimates are to be accepted with caution, and to this rule the estimates published by the Canadian and Argentine Governments in October and November respectively are no exceptions. Russian official estimates are often called in question, and in dealing with Russian statistics it must not be forgotten that two distinct bases of calculation are used by the Department of Agriculture. The figures published in the later autumn are the most trustworthy. Russian official crop estimates have often exaggerated the yield, but the returns respecting the port stocks and the weekly shipments of grain are believed to be fairly accurate.

Unsafe Official Statistics.

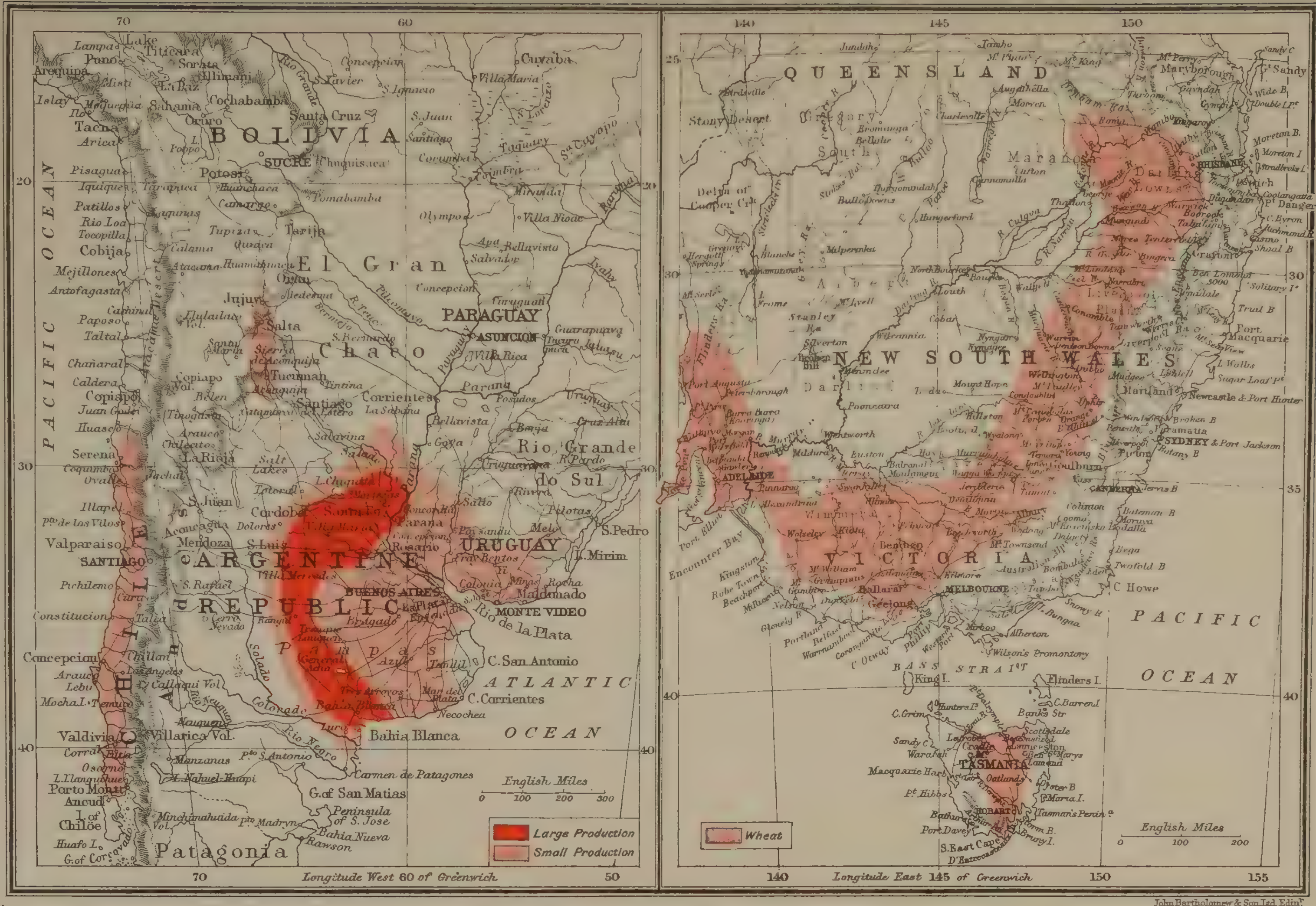
Indian official statistics of the crops of grain are carefully compiled, and are usually trustworthy. The French official crop statistics are prepared with due diligence and are worthy of more or less respect, though they are periodically assailed by the millers' association, which conducts an enquiry on its own authority and maintains that the official figures are persistently understated.

It will be seen that whereas in some countries officials have a tendency to overestimate harvests, in others the bias is just the other way. In this connection it must not be forgotten that in a land which raises a huge cereal crop it is the interest of the growers, to put it mildly, not to exaggerate the size of harvests, because of the obvious tendency of a big supply to depreciate prices. Whether this consideration has ever induced officials of set purpose to minimize crop results is a moot point. It is more probable that official crop estimators have erred, when they have erred, through ignorance. The task of estimating a crop, especially in the early days, is by no means easy. A special difficulty in the path of an official estimator is due to the suspicions which any man with a pencil, notebook, and an official air invariably arouses in the breasts of rustics. He is looked on as a taxgatherer in disguise, and it would be surprising if he received information of unimpeachable accuracy. Our own Board of

Official Bias.

Possible Cause of Small Estimates.

Farmers Dislike Officials.



THE CHIEF WHEAT-GROWING REGIONS

IV–SOUTH AMERICA

V–AUSTRALIA

Agriculture has not always been very successful in estimating the size of our crops, which nowadays are considered respectable if they run to 7,500,000 qr. What must be the task before the French estimators who have to get a fairly close estimate of a crop of 42,000,000 qr. or more? The German official figures are generally trustworthy, and the same may be said of the Austro-Hungarian returns.

Of course, standing crops are not secure till they are in the barn or otherwise under cover. The old proverb concerning the many a slip betwixt cup and lip has been brought home with bitter force to many a farmer, who has seen a valuable crop destroyed or sorely depreciated within a week or so of harvest. It is easy to understand what interest the market takes in weather reports while crops are in the critical stage, or are fast approaching the cutting period. Wheat is heir to almost as many ills as flesh itself. A cold snap in May might catch the plant in the milky stage and wither it; in climates like that of Western Canada and North-Western America this is a special danger to which spring wheat is exposed if sown late. The plant will under such conditions not enter the critical period of its growth till night frosts have made their appearance, which may be in August or at the end of July, and then the wheat is nipped with disastrous effects to its gluten. Flour milled from frosted wheat is apt to make "runny" dough, something like flour made from sprouted wheat. Wheat again may be killed by severe frost when it has just emerged from the ground; this has happened more than once to winter wheat in such parts of the United States as Kansas and Missouri. The plant perished for lack of a covering of fleecy snow. At certain periods of the life of wheat drought is almost as harmful as too much water at another stage. In this country probably more mischief has been wrought by untimely and protracted rains. In very wet summers as large a proportion as 25 per cent of the British crop is unfit for milling. How serious a calamity a wet harvest must have been in the days, not so far removed from us, when this land grew three-fourths of its wheat, can easily be imagined. A metropolitan baker of venerable aspect once assured the writer that he remembered in the old days alum going into his own shop by the hundredweight after a wet harvest. Hundredweight was palpably a gross exaggeration, but that alum was largely used in those days after the crop had been gathered wet is a fact that none of the older generation of bakers would dispute.

Weather Reports Influence Prices.

Effects of Cold in May.

Frosts Destroy Spring Wheats.

Drought Damages Wheat.

Damage by Rains.

Use of Alum with Sprouted Wheat Flour.

A chapter might be written on "weather markets" and their history. Naturalists tell us that the petted lapdog, when he twists round and round before settling himself on the cosy hearthrug, is merely repeating the trick his remote ancestors acquired when they made their beds on dry leaves in the forests. In the same way the baker to-day is often much concerned by rainy weather in July, though to-day the native wheat crop forms but one-fifth of our breadstuffs supply instead of three-fourths. Yet Mark

Lane itself, the headquarters of the corn trade, is proverbially sensitive to weather influences. Fine weather in June has a softening, rain in July a hardening trend. Yet in this market about 1 qr. of English wheat is sold as compared with 30 qr. of foreign wheat, which grows and ripens irrespective of the vagaries of this climate. Of course, the proportion of wheat still raised in this country, insignificant as it may be, relatively speaking, is an item in our breadstuffs supply which could not drop out without the market being very seriously affected. But rain in this country, even unduly prolonged, while the wheat is fast ripening to harvest, has not the same dire significance it had in the days of our fathers.

Mark Lane Influenced by Weather.

While weather has a strong influence on markets--severe drought in India leading to famine is a familiar example—it is always advisable to scan carefully reports of crop damage from bad weather, from whatever quarter such news comes. Crop scares, as they are termed, are always more or less in season in the spring of the year, when the growing wheat in many lands is in a critical condition. Sometimes the scare has a large substratum of truth; very often an ounce of fact is worked into a ton of misrepresentation. Such scares are the stock in trade of the bull party in the option markets of America, which play so important a part in fixing wheat values in that country.

Crop Scares.

Bulls Raise Prices by Scares.

CHAPTER XV

FORWARD TRADING AND OPTIONS

No account, however sketchy, of the wheat market could be complete without some reference to the system of forward trading, known both as futures and options, which has become so great an institution in America, and is in active existence at Liverpool, the greatest wheat market of the Old World. An "option" deal is a transaction in which a merchant or speculator sells a quantity of wheat or other produce which he may not possess, this sale to be completed by the stipulated delivery of the goods at some future time, say three months after the bargain was made. At the end of that period the seller in the majority of cases delivers no produce—because usually he has none, and did not intend to have any, to deliver—but if the then market price of the commodity in which the deal took place had risen in price the seller would require to pay the buyer cash equivalent to the amount of the difference in the price at which the stuff had been sold and the higher market price at the time of stipulated delivery. But if, on the other hand, prices had fallen, then the buyer would have to hand over to the seller the difference between the market price at stipulated time of delivery and that at which the com-

Nature of an Option.

History of London Options.

Business "on the Nod".

Leiter Corner in Wheat.

modity had been sold. Options and futures have often formed the subject of leading and other articles in the daily press, where they are usually denounced as instruments of sheer gaming. With the morality of options this article is not concerned, but we will endeavour to give some account of their actual operation and effects on the market. Options are not a very ancient institution. In America they date from about forty years or so ago. The flourishing future markets of Liverpool was started some thirty-five years since. London for some reason or other has never taken kindly to options, though in the eighties an option market was started and worked for some little time. It died out, but was succeeded by a much better organized market in 1896, which for a time had a good deal of vogue. The contracts were guaranteed by the Produce Brokers Exchange, and for some years two "calls" were held daily on the Baltic, while little groups of brokers used to do business "on the nod", as it was called, at Mark Lane, whenever there was any activity in wheat. These contracts had all to be registered by the exchange. The revived London market was stopped after fourteen years' existence. Its death-blow came from the dearth of American and Canadian spring wheat, resulting from the poor crops of 1903 and 1904. The original contract basis of the London option market was No. 1 Northern Duluth; later on it was permissible to substitute spring wheat of equal quality for this grade. With regard to this point, it must not be supposed that in dealing with options or futures it is allowable to sell or buy any kind of wheat. A contract grade is invariably fixed by the exchange, and the seller may be called on by the buyer to actually tender the wheat he has sold. Wheat of different grade or inferior quality can usually be tendered, but only on payment of a penalty, which in some cases is prohibitive. Older bakers may remember that during the historic Leiter corner in Chicago in 1898, Armour, the packing king as he was often called, from the huge meat-preserving business he controlled in Chicago, sold Joseph Leiter immense quantities of wheat, and by dint of great exertions rushed train after train of cars of wheat from the north-west into Chicago to be ready to meet his engagements. When the scarcity of American springs brought London options to a standstill, an attempt was made to find a substitute in Argentine and Indian wheats (which just then were plentiful), but the attempt failed, and options in London are now a thing of the past.

Gambling in Futures.

In Liverpool it is far otherwise. The futures market there has become a great commercial institution. The main objection taken to future dealings in produce by moralists lies in the facilities it affords for gambling. But the Liverpool futures market is so conducted that every obstacle is put in the way of the outsider, who is merely anxious "to have a flutter", as the saying goes. The same was true of the London option market while it existed. Under the Liverpool system no operator can make a deal in futures without providing a "margin", the equivalent of the cover demanded by the stockbroker from his clients. All differ-

ences have to be settled day by day, and as soon as a margin is eaten up the depositor is notified of the fact, whereupon a further margin is required before fresh business can be transacted. It is quite safe to say that an overwhelming proportion of the futures put through in Liverpool is on account of solid business firms engaged in the corn trade. The object of these transactions is to hedge some deal in actual wheat or maize. A merchant may have bought a cargo of wheat to arrive at or about a certain date, and to avoid the risk of the wheat declining before its arrival he will sell an option against it. In this way he can generally insure himself to some extent against loss on his deal in wheat. Big millers by buying an option may cover forward sales of flour. It has already been explained that the buyer of an option or future can compel a tender of the actual wheat, or enforce a penalty for non-compliance with this condition, but, as a matter of fact, the amount of wheat actually tendered is very small, probably not more than 3 per cent of the actual quantities bought. The difference is usually settled in money, which really meets the case exactly, because the main object of those who engage in these operations is to "hedge" themselves against loss on transactions in actual grain. Of course options can never be altogether destitute of some risk. In "hedging" operations care has to be exercised, or the merchant may lose both on the purchase of actual wheat and on the option he has sold to cover his purchase. This does sometimes happen, and there are instances on record in which the consequences of such an operation have been disastrous. But double losses of this description are the exception and not the rule. Whatever abuses options may have engendered in such a market as Chicago, they have their commercial uses. A Manitoba miller, for instance, may sell flour to a London importer for September–October dispatch two months or so before harvest. But with a really promising crop the option will probably enable the miller to sell at a workable price. He can effectually cover his sale by buying an option, which thus fills the place for him of actual wheat. Broadly viewed they are a means of insuring corn merchants against those heavy losses which were so marked a feature of the trade in the middle of the last century and even up to thirty years ago. Nowadays we rarely hear of the smashes which used periodically to strew the corn exchange with wrecks, and this is in some degree due to the judicious use of options. The corn trade is, from its very nature, full of risk, and in the old days when wheat was liable to rise or drop 10*s.* per quarter in a single day, when the telegraph had no existence, and merchants had to work practically in the dark, it must have been one of the most hazardous branches of commerce. Nowadays when a corn merchant fails it is almost always his own fault. Either he has been trading with insufficient capital, or he has been guilty of rash speculation.

Real Business in Futures.

Losses in Corn Trade.

One possible but not wholly welcome effect of the option system is this, that it may have reduced the stocks of wheat maintained in our ports. This, from the point of view of our national security, is an undoubted

drawback, but it is an inevitable corollary of the conditions of to-day. Our average imports of breadstuffs at the present time are about treble those of forty years ago, but the stocks nowadays held by importers are not one-third of those maintained thirty years back. This cannot be all due to options. Putting aside Californian wheat, some of which may be brought here in sailing vessels, the corn trade carries on its shipping operations entirely by steam. Hence merchants can get wheat to this country even from distant parts in as many weeks as it formerly took months. Moreover, ocean cables enable an order to be flashed round the world in no time. Apart from the risks of shipwreck and war—two contingencies which our forefathers described as acts of God and of the king's enemies—the importer to-day can buy his wheat at almost any point on the globe where it may be to his advantage to purchase, and can forecast with reasonable certainty when it will reach him. Necessarily there is not the need for big stocks which existed twenty-five to thirty years ago, despite the fact that the home production is not above one-half of what it was then. But still options may have helped to lessen the stocks carried by importers. They might have that effect merely from the facility they give the merchant for buying at his own good time.

Option Trading tends to Reduce Port Stocks.

Sailing and Steam Ships.

Why Small Stocks are Kept.

The charge has often been made against options that they place the market at the mercy of manipulators or "riggers", as people like to call them. This is partly true, but it is also much exaggerated. In the middle of the nineties, when wheat dropped for a time to 20s. per quarter, the cry was heard that the poor farmer could not get a fair price for his crop because speculators were "bearing" wheat, that is selling options of wheat. But a year or two passed, and the Leiter corner startled the world as perhaps it had not been moved since the dark days of the Irish famine, or of the bread riots in Britain and France at the close of the eighteenth and the dawn of the nineteenth century. It was about the year 1891 that a great convention of millers was held at Minneapolis, and passed a resolution denouncing options as tending to inflate wheat values. Only a few weeks before, a mass meeting of farmers held at some place in Minnesota had passed a resolution declaring that options unduly depressed wheat values. Now fluctuations in the prices of barley have during the past twenty years been quite as sharp, to say the least, as those of wheat and maize. But though Chicago, New York, and Liverpool have options on wheat and maize, they know nothing of future dealings in barley.

Rigging the Market.

Those who accuse gamblers of making wheat dear, or the reverse, by means of option or future dealings are simply confusing cause and effect. Neither wheat, cotton, nor any other article which is the subject of futures, has ever been made dearer or cheaper merely by "bulling" and "bearing". The market operations so described consist simply of buying and selling, and are not purely haphazard work. Those who dabble in such business base their operations, if they are speculators, on the statistical position. Their deals represent their views of the

Bulls and Bears.

market, because obviously no one would bull or buy wheat unless he expected a rise of some sort, while nobody would bear or sell unless he looked for a drop. But the essential point to remember is this, that both buyer and seller work according to their reading of the market. The bull may depend on what he deems to be growing demand, and may or may not underestimate supply. The bear, on the other hand, may or may not overestimate supply. In either case these "futures" are largely based on estimates, correct or incorrect, of supply and demand, the only real basis of market values. It is quite incorrect to suppose that the market is ruled by sales or purchases of paper wheat, though it is perfectly true that the vast majority of option sales represent fictitious sales in the sense that the bargain concluded will be adjusted not by payment against delivery of goods, but by a payment of price difference. No one, however, is deceived by the magnitude of these fictitious sales into believing the actual supply is larger than it is—no one, that is, who has any knowledge of the market. The truth is that no gambler, however bold, can pull a market up or down when the force of nature is pulling the other way.

Paper Sales Don't Influence Market.

It must not be supposed that Leiter made his corner by merely buying "paper wheat". In the course of his operations he held at one time 1,600,000 qr. of actual wheat, and controlled about 3,500,000 qr. more. During the months he was busy with wheat he exported over 3,000,000 qr., a good deal of which came to this country. He bought wheat at the opening of his deal at 21*s.* 7*d.* per quarter of 480 lb., which was forced for a time as high as 61*s.* 8*d.* per quarter. Had he realized his profits in May, 1898, many people believe he would have cleared £1,000,000 sterling. As it was, he ultimately lost that sum, and a good deal over. The end of the Leiter corner has been graphically but truthfully described by Norris in his realistic novel *The Pit*, which deals with a fictitious character who attempted a huge corner and failed, just as Leiter failed. "Corner wheat! It's the wheat that has cornered me. It's like holding a wolf by the ears; bad to hold on, but worse to let go." Finally, the bold speculator was overwhelmed by a wheat avalanche: "It was the wheat, the wheat! It was on the move again. From the farms of Illinois and Iowa, from the ranches of Kansas and Nebraska, from all the reaches of the middle west, the wheat, like a tidal wave, was rising, rising. Almighty, blood-brother to the earthquake, coeval with the volcano and the whirlwind, that gigantic world-force, that colossal billow, Nourisher of the Nations, was swelling and advancing." Such will be the end of any subsequent attempt to corner wheat if continued long enough. Leiter, as we have seen, would have made huge profits had he stopped in time; but that the gambler never can manage.

Power Behind Leiter Operations.

Though in the long run supply and demand set futures and options at defiance, it would not be true to say that corners are figments of imagination. In a small way corners are being run all the year round in option markets, but they seldom go

Possibilities of Small Wheat Corners.

far. They are not intended to. A strong speculator or a syndicate of operators will make a corner whenever a contract grade happens to be rather short; but, generally speaking, these manipulations are soon over. The bulls who have engineered the corner take their profits; then there is a break, and the bears have their way again. These operations are termed manipulations, and in a sense they are; but it is impossible to manipulate a market in any direction unless there is some element of strength or weakness on which the operator can work. The worst that can be alleged against options is this, that in the hands of determined operators they tend to exaggerate the effects both of scarcity and abundance. Had no Leiter corner been made, the diminished supply of wheat in the world would have brought high prices in the 1897–8 cereal year, but probably not such sensational figures as were actually reached. The reaction from such high prices is invariably severe, and for a time values are apt to be unduly depressed. In times of great abundance the bears have their look in, but it is clear that there can be no bears without bulls, and conversely no bulls without bears: the seller presupposes a buyer, and vice versa.

Speculators can Work with Tide Only.

Perhaps the best way of getting an idea of the real factors underlying the movements of the option markets is to take one day's telegrams from Chicago and New York. Here is the record of the doings of May, 18, 1906, in the Chicago "Futures" market:— "Wheat opened easy, $\frac{1}{4}$ to $\frac{1}{2}$ c. lower, on unfavourable cables, weakness in Minneapolis, heavy weekly shipments from Argentina, commission house selling, and much-needed showers falling in Kansas. An advance ensued on unfavourable crop news from the Ohio Valley, good outside support, active covering of shorts, a better demand for cash grain at Minneapolis, and a bullish 'Modern Miller' report. Realizing and commission house selling caused a reaction finally, and the market closed barely steady, $\frac{1}{8}$ to $\frac{1}{2}$ c. down.

A Day's Movement of the Chicago Market.

	May.	July.	Sept.	Dec.
To-day	$84\frac{5}{8}$	$82\frac{1}{2}$	$80\frac{5}{8}$	$80\frac{1}{2}$
Yesterday ...	$84\frac{3}{4}$	83	$80\frac{7}{8}$	$80\frac{7}{8}$"

Now let us take the New York report for the same day. It ran:— "Wheat opened easy, at $\frac{1}{4}$ c. full, and further weakened under adverse cables, lower Minneapolis advices, heavy weekly shipments from the Argentine, showers in Kansas, and commission house selling, then rallied on good outside support, bad crop news from the Ohio Valley, active covering of shorts, and a better demand for cash grain at Minneapolis. Subsequent realizing was offset by the bullish 'Modern Miller' report, but commission houses sold later, and market closed barely steady, at $\frac{1}{2}$ c. fall.

The New York Market.

	May.	July.	Sept.	Dec.
To-day	$90\frac{1}{2}$	$88\frac{1}{2}$	$85\frac{5}{8}$	86
Yesterday ...	91	89	$86\frac{1}{8}$	—"

It may be noted that the contract grades, which form the basis of all dealings in options, are not identical at Chicago and New York. Nevertheless the two markets, as we have seen, are dominated by much the same factors, and run, so to speak, on parallel lines. Both markets are very sensitive to shipping activity, to crop reports, to the condition of other American markets, as well as to the market operations known as "covering", "realizing", and "commission house selling". So sensitive are these markets to weather reports that at critical seasons mere predictions of needed rain will affect prices. It will be observed that prices were higher at New York than at Chicago, the May option in the latter market being about equal to 28*s.* 2*d.* per quarter of 480 lb. as compared with 30*s.* 2*d.* at New York. The more distant months were lower in price, till December wheat fell to 28*s.* 8*d.* at New York and 26*s.* 10*d.* at Chicago. This means, of course, that the market looks on wheat in December as likely to be cheaper than May, July, or September. Without for one moment attributing infallibility to the option market quotations, they are unquestionably an index to the trend of prices that no student of the markets can afford to neglect.

Why Market Prices Vary.

CHAPTER XVI

FACTORY LAWS

The theory of the courts is that everybody knows the law; at least the plea of ignorance is not accepted as an excuse for any breach of a law. The practice of the courts and the business of lawyers are maintained because so few people know the law. Bakers, so far as they are bakehouse or factory owners, are subject to the general regulations which apply to all non-textile factories, as well as to some regulations specially applicable to the trade. The statute containing the greater part of these regulations is the "Factory and Workshop Act, 1901". Section 1 of this Act deals with sanitary regulations. The most important of these applicable to bakeries is the necessity for periodic cleaning and limewashing of the walls, but the special regulations are given farther on. Under the Ministry of Health Order, 1921, the powers for administering the Factory Acts as applicable to bakeries are transferred to the Ministry of Health in England and to the Scottish Board of Health, Scotland. Many factory regulations are now issued from the departments direct under somewhat wide powers conferred by the statutes, so that the law is becoming less statutory regulations and more and more official, and therefore liable to frequent change. The practice of giving very wide powers to departments began in 1915.

Factory and Workshop Act, 1901.

Powers of Medical Officers and Inspectors.

Section 6 of the Act is of interest to bakers, although its provisions are rarely insisted upon in their case, as it was evidently intended to

apply to factories that might be too cold rather than to those that might be too hot. "In every factory and workshop adequate measures must be taken for securing and maintaining a reasonable temperature in each room in which any person is employed, but the measures so taken must not interfere with the purity of the air of any room in which any person is employed. The Secretary of State may, by special order, direct with respect to any class of factories or workshops, that thermometers be provided, maintained, and kept in working order, in such place and position as may be specified in the order."

Regulations as to Temperature of Factory.

Section 9 of the Act decrees that "Every factory and workshop must be provided with sufficient and suitable accommodation in the way of sanitary conveniences, regard being had to the number of persons employed in or in attendance at the factory or workshop, and also where persons of both sexes are or are intended to be employed, with proper separate accommodation for persons of each sex". What is sufficient and proper accommodation may be determined by the Secretary of State, of course through the inspectors.

Sanitary Conveniences.

In view of the provisions of the Workmen's Compensation Act it is of great importance that the regulations in the Factory Act regarding fencing of machinery and steam boiler regulations should be attended to. The former is dealt with in Section 10. "Every hoist or teagle, and every flywheel directly connected with the steam or water or other mechanical power, must be securely fenced. . . . All dangerous parts of the machinery and every part of the mill gearing, must either be securely fenced, or be in such position or of such construction as to be equally safe to every person employed or working in the factory as it would be if it were securely fenced. All fencing must be constantly maintained in an efficient state while the parts required to be fenced are in motion or use, except where they are under repair or under examination in connection with repair, or are necessarily exposed for the purpose of cleaning or lubricating or for altering the gearing or arrangements of the parts of the machine."

Fencing Machinery.

Section 11 reads thus: "Every steam boiler used for generating steam in a factory or workshop, or in any place in which any of the provisions of the Act apply, must, whether separate or one of a range, have attached to it a proper safety valve, and a proper steam gauge and water gauge, to show the pressure of steam and the height of water in the boiler, and be examined thoroughly by a competent person at least once in every fourteen months."

Steam Boiler Regulations.

Under this Act, in the case of a factory where more than forty persons are employed, provision must be made for means of escape in the case of fire, and should any dispute arise between the owner of such factory and the occupier as to the cost of alterations to premises in compliance with the Act, the case may be settled by an appeal to the county court (in Scotland, the sheriff court), the judge at

Escape in Case of Fire.

which may make an order allocating the cost of the alterations "as appears to the court just and equitable under all the circumstances of the case". When a difference of opinion arises between the owner of a factory or workshop and the council with regard to means of escape in the case of fire, this difference may, on the application of either party, within one month after the time when the difference arises, be referred to arbitration, the finding of the arbiters to be binding on both parties.

Workrooms must not be Locked.

For the purpose of safety Section 16 of the Act provides that "While any person employed in a factory or workshop is within the factory or workshop for the purpose of employment or meals, the doors of the factory or workshop, and of any room therein in which such person is, must not be locked or bolted or fastened in such a manner that they cannot be easily and immediately opened from the inside". It is also enacted that in any factory or workshop built after 1896 in which more persons than ten are employed the doors, except in the case of sliding doors, must be constructed so as to open outwards.

Reporting Accidents.

If an accident occurs in a factory or workshop which causes loss of life, or such bodily injury to a person employed as to prevent him on any one of the three working days next after the occurrence of the accident from being employed for five hours on his ordinary work, written notice must be sent to the inspector of the district. If the accident has been caused by "machinery moved by steam, water, or other mechanical power, or through a vat, pan, or other structure, filled with hot liquid or molten metal or other substance, or by explosion or by escape of gas, steam, or metal", notice must be sent to the certifying surgeon for the district. This notice must state the residence of the person killed or injured, and the place to which he has been removed. The certifying surgeon is then required to proceed "with the least possible delay" to the factory or workshop and make a full investigation as to the nature and cause of the death or injury caused by that accident, and to send a report to the inspector within the next twenty-four hours.

Duties of Medical Officer Regarding Accidents.

Display of Abstracts and Notices.

Inspectors of workshops and factories are as a rule very particular as to the display of notices and abstracts required by the Factory Act. This is dealt with in Section 128. "There shall be affixed at the entrance of every factory and workshop (in which women or young persons are employed), and in such other parts thereof as an inspector for the time being directs, and be constantly kept so affixed in the prescribed form and in such position as to be easily read by the persons employed in the factory or workshop, (*a*) the prescribed abstract of the Act, (*b*) a notice of the name and address of the prescribed inspector, (*c*) a notice of the name and address of the certifying surgeon for the district, (*d*) a notice of the clock (if any) by which the period of employment and times for meals in the factory or workshop are regulated, (*e*) every notice and document required by the Act to be affixed to the factory or workshop." In addition to the display of notices

a register has to be kept showing, "(a) the children or young persons employed in the factory or workshop, (b) the limewashing of the factory or workshop, (c) every accident occurring in the factory or workshop of which notice is required to be sent to an inspector, (d) every special exemption of which the occupier of the factory or workshop avails himself, and (e) such other matters as may be prescribed". This register has at all reasonable times to be open to inspection by the certifying surgeon of the district.

Keeping a General Register.

When a new factory is about to be opened it is required of the occupier that he, "within one month after he begins to occupy a factory or workshop, serve on the inspector for the district a written notice containing the name of the factory or workshop, the place where it is situate, the address to which he desires his letters to be addressed, the nature of the work, the nature and amount of the moving power therein, and the name of the person or firm under which the business of the factory or workshop is to be carried on". It is the duty of the inspector after receiving this notice to advise the district council of the district in which the workshop is situate.

Reporting Opening of a Factory or Workshop.

There are special regulations for the employment of youths over sixteen and under eighteen in bakehouses (Sec. 38): "1. In the part of a bakehouse in which the process of baking bread is carried on, the period of employment for any male young person above the age of sixteen years may be between five o'clock in the morning and nine o'clock in the evening, if he is employed in accordance with the following conditions, namely: (a) Where he is employed on any day before the beginning or after the end of the ordinary period of employment, there must be allowed him for meals and absence from work between the above-mentioned hours of five in the morning and nine in the evening not less than seven hours; (b) where he is employed on any day before the beginning of the ordinary period of employment, he must not be employed on the same day after the end of that period; (c) where he is employed on any day after the end of the ordinary period of employment, he must not be employed next morning before the beginning of the ordinary period of employment. 2. For the purposes of this exception the ordinary period of employment means the period of employment for women or young persons under the age of sixteen years in the bakehouse, or, if none are employed, means such period as can under this Act be fixed for the employment of women and young persons under the age of sixteen years in the bakehouse, and notice of that period shall be affixed in the bakehouse."

Young Persons in Bakehouses.

Sanitary and other regulations for bakehouses are dealt with in Sect. 97 thus: "(1) It shall not be lawful to let or suffer to be occupied or to occupy any room or place as a bakehouse, unless the following regulations are complied with: (a) a water closet, earth closet, privy, or ashpit must not be within or communicate directly with the bakehouse; (b) every cistern for supplying water to

Bakehouse Sanitary Regulations.

the bakehouse must be separate and distinct from any cistern for supplying water to a water closet; (*c*) a drain or pipe for carrying off fæcal or sewage matter must not have an opening within the bakehouse". Section 98 provides: "Where a court of summary jurisdiction is satisfied, on the prosecution of an inspector or a district council, that any room or place used as a bakehouse is in such a state as to be on sanitary grounds unfit for use or occupation as a bakehouse, the occupier of the bakehouse shall be liable to a fine not exceeding, for the first offence, forty shillings, and for any subsequent offence £5". But if the occupier persists in refusing or neglects to make the alterations required by the court, the amount of the fine may be raised to £1 per day as long as the non-compliance continues.

Painting and Limewashing.

Section 99 enacts thus: "All the inside walls of the rooms of a bakehouse, and all the ceilings or tops of those rooms (whether those walls, ceilings, or tops are plastered or not), and all the passages and staircases of a bakehouse, must either be painted with oil or varnished or be limewashed, or be partly painted or varnished and partly limewashed. (*a*) Where the bakehouse is painted with oil or varnished, there must be three coats of paint or varnish, and the paint or varnish must be renewed once at least in every seven years, and must be washed with hot water and soap once at least in every six months; (*b*) where the bakehouse is limewashed, the limewashing must be renewed once at least in every six months."

Sleeping Rooms near Bakehouse.

Section 100 enacts that (1) "A place on the same level with a bakehouse, and forming part of the same building, may not be used as a sleeping place unless it is constructed as follows: (*a*) is effectually separated from the bakehouse by a partition extending from the floor to the ceiling; (*b*) has an external glazed window of at least nine superficial feet in area, of which at least four and a half superficial feet are made to open for ventilation".

Underground Bakehouses.

Section 101 deals with underground bakeries. "(1) An underground bakehouse shall not be used as a bakehouse unless it was so used at the passing of this Act (1901). (2) Subject to the foregoing provision, after Jan. 1st, 1904, an underground bakehouse shall not be used unless certified by the district council to be suitable for that purpose. (3) An underground bakehouse shall mean a bakehouse, any baking room of which is so situate that the surface of the floor is more than three feet below the surface of the footway of the adjoining street or of the ground adjoining or nearest to the room. The expression 'baking room' means any room used for baking, or for any process incidental thereto. (4) An underground bakehouse shall not be certified as suitable unless the district council is satisfied that it is suitable as regards construction, light, ventilation, and in all other respects. . . .

The air space or cubic capacity of an underground bakehouse must be 500 cubic feet of space to every person working there. Regarding level bakehouses where work is carried on at night by artificial light, other than electric light, the space allowed for each person must be

400 cubic feet. Night work refers to the period between nine in the evening and six in the succeeding morning. (7) In the event of a refusal of a certificate by the district council, the occupier of the bakehouse may, within twenty-one days from the refusal, by complaint apply to a court of summary jurisdiction, and if it appears to the satisfaction of the court that the bakehouse is suitable for use as regards construction, light, ventilation, and in all other respects, the court shall grant a certificate of suitability of the bakehouse, which shall have effect as if granted by the district council. (8) Where any place has been let as a bakehouse, and the certificate required by this section cannot be obtained unless structural alterations are made, and the occupier alleges that the whole or part of the expenses of the alterations ought to be borne by the owner, he may by complaint apply to a court of summary jurisdiction, and that court may make such order concerning the expenses or their apportionment as appears to the court to be just and equitable under the circumstances of the case, regard being had to the terms of any contract between the parties, or in the alternative the court may, at the request of the occupier, determine the lease.

Retail Bakehouses.

Section 102 reads: "as respects every retail bakehouse, the provisions of this part of the Act shall be enforced by the district council of the district in which the retail bakehouse is situate, and not by an inspector; and for the purposes of this section the medical officer of health of the district council shall have and may exercise all the powers of entry, inspection, taking legal proceedings, and otherwise of an inspector. In this section the expression 'retail bakehouse' means any bakehouse or place, not being a factory, the bread, biscuits, or confectionery baked in which are sold not wholesale, but by retail, in some shop or place occupied with the bakehouse." In these sections relating specially to bakehouses, "district council" must be interpreted in Scotland as the local authority under the Public Health Act of 1897.

The above summary of the general provisions of the Factory Act to which occupiers of bakeries must conform, as well as the provisions specially designed to apply to bakeries, will be of assistance to those about to open a bakery, or to others who may be unaware of the regulations, and either lay themselves open to prosecution by an inspector or be harassed by exacting regulations made by district councils or inspectors that have no sanction in the Act. The trade has now ceased to consider the requirements of the Factory or Public Health Acts galling, and the rule rather is, in the matter of cleanliness, construction, ventilation, and the regulation of junior labour, to be far in advance of the requirements of the law. The provision of the Act which prevents youths under eighteen from starting work until after 5 a.m. has made a great many masters refuse to employ boy labour at all, and one of the effects has been to prevent as thorough a training of operative bakers as in the time when they went from early youth through a long apprenticeship.

APPENDIX TO CHAPTER XVI

MANUFACTURE OF CHOCOLATES OR SWEETMEATS

[Confectioners who make chocolates as only a small part of general work are probably not required to conform to the following regulations, but those who do sufficient to make the establishment of a separate department necessary must conform.]

ORDER DATED 27TH FEBRUARY, 1912

In pursuance of Section 116 of the Factory and Workshop Act, 1901, the following Order is hereby made:—

The provisions of the said section shall apply, subject to the modifications hereinafter contained, to factories and workshops in which the undermentioned processes, or any of them, are carried on, and to out-workers employed in those processes and the occupiers and contractors by whom they are employed:—

The Manufacture of Chocolates or Sweetmeats, and any work incidental thereto.

The said section shall be modified sô as to read as follows:—

(1) The occupier or contractor shall, for the purpose of enabling each worker who is paid by the piece to compute the total amount of wages payable to him in respect of his work, cause to be published particulars of the work and rate of wages applicable thereto, as follows:—

(*a*) He shall furnish every worker with written particulars of the rate of wages applicable to the work done by him in one of the following ways:—

(i) By furnishing the worker with such particulars on each occasion when the work is given out to the worker.

(ii) By furnishing the worker at or before the time of his first employment on any class of work with a notice containing the particulars applicable to that class of work, and on every subsequent occasion when new rates are fixed, a further notice stating the new rates and the date from which they are to come into operation. If the worker accidentally loses or destroys his notice, another copy shall be furnished to him by the employer free of charge.

(iii) By exhibiting in the case of persons employed in a factory or workshop such particulars on a placard in the department where the work is done.

(*b*) Such particulars of the nature and amount of the work to be done by each worker as affect the amount of wages payable to him shall be furnished in writing at the time when the work is given out to him. Provided that in the case of persons employed in a factory or workshop (i) it shall not be necessary to furnish particulars of the nature of the work where the work is of a standard class which is sufficiently indicated by the materials given out and which is denoted in a placard exhibited as aforesaid and containing the rate of wage for the work by a description or name sufficiently indicating its nature; (ii) if particulars of the amount of work on which the worker is paid are not ascertainable until the work is completed, such particulars shall as soon as practicable after the completion of the work be furnished in writing to the worker or exhibited on a placard in the department in which the work is done.

(2) Where the work is given out to be done in common by a gang of workers the particulars required to be given shall be—

(*a*) The rate of wages applicable to the work to be done by the gang and the proportions (if fixed by the employer) according to which the wages of the several members of the gang are calculated.

(*b*) Such particulars of the work to be done by the gang as affect the amount payable to the gang.

The occupier may in lieu of furnishing each member of the gang with written particulars of the work, exhibit them on a placard in the department in which the work is to be done.

(3) If the worker is required to return any written particulars or to hand them on with the work to another worker, either (*a*) a copy shall be furnished to the worker which he may retain for his own use, or (*b*) a book shall be supplied to the worker in which he may enter such particulars; this book shall be produced by the worker for examination by the person receiving the work on behalf of the employer, who shall initial the entry if found correct.

(4) The particulars, either as to rate of wages or as to work, shall not be expressed by means of symbols.

(5) Any placard exhibited in pursuance of the foregoing provision shall contain no other matter than particulars of rates of wages or of work as the case may be, and shall be affixed in such a position as to be easily read by all persons to whose work the particulars relate.

(6) If the occupier or contractor fails to comply with the requirements of this section, he shall be liable for each offence to a fine of not more than ten pounds, and, in the case of a second or subsequent conviction within two years from the last conviction for that offence, not less than one pound.

(7) If anyone engaged as a worker in any of the aforesaid classes of work, having received such particulars, whether they are furnished directly to him or to a fellow workman, discloses the particulars for the purpose of divulging a trade secret, he shall be liable to a fine not exceeding ten pounds.

(8) If anyone for the purpose of obtaining knowledge of or divulging a trade secret, solicits or procures a person so engaged to disclose such particulars, or with that object pays or rewards any such person, or causes any person to be paid or rewarded for so disclosing such particulars, he shall be liable to a fine not exceeding ten pounds.

In this Order the term "out-worker" means—

(*a*) Any workman employed in the business of a factory or workshop outside the factory or workshop, whether directly by the occupier thereof or by any contractor employed by him.

(*b*) Any workman employed by the occupier of any place from which work is given out or by a contractor employed by him in connection with the said work.

(*c*) Any contractor employed by the occupier of a factory or workshop on the business of the factory or workshop outside the factory or workshop, or employed by the occupier of a place from which work is given out in connection with the said work, except a contractor who does not personally do any part of the work which he undertakes.

Provided that in the last-mentioned case a person employing a contractor shall not be liable to a fine for any failure to furnish him with particulars if he shows to the satisfaction of the Court that he had reasonable ground for believing that the contractor was the occupier of a factory or workshop and that the work given out would be wholly done by persons employed by the contractor and no part thereof by the contractor personally.

FRUIT PRESERVING AND MINERAL WATERS

[As an increasing number of confectioners and caterers are now bottling fruit for their own use, and making and bottling mineral water, the following regulations made in 1919 with regard to fruit preserving and in 1921 with regard to mineral waters should be carefully noted.]

In pursuance of Section 7 of the Police Factories, &c. (Miscellaneous Provisions) Act, 1916, the following Order is made for all factories or parts of factories in which the preserving of fruit is carried on.

1. The occupier shall provide and maintain in good condition suitable protective clothing for the use of all persons employed in the processes of preparing and boiling fruit, filling, finishing and covering filled vessels, spinning on tops, and in any wet process.

2. The occupier shall provide and maintain for the use of all persons employed in the factory suitable accommodation for clothing put off during working hours, with adequate arrangements for drying the clothing if wet.

The accommodation so provided shall be placed under the charge of a responsible person and shall be kept clean.

3. The occupier shall provide and maintain for the use of all persons employed and remaining on the premises during the meal intervals a suitable messroom, which shall be furnished with (*a*) sufficient tables and chairs or benches with back rests, (*b*) unless a canteen serving hot meals is provided on the premises, adequate means for warming food and boiling water, and (*c*) suitable facilities for washing, comprising a sufficient supply of clean towels, soap and warm water. The messroom shall be sufficiently warmed for use during meal intervals.

The messroom shall be separate from the cloakroom, and shall be placed under the charge of a responsible person, and shall be kept clean.

4. There shall be provided and maintained, for the use of all persons employed in the processes of picking, preparing and boiling fruit, filling, and finishing and covering filled vessels, suitable facilities for washing, comprising a sufficient supply of clean towels, soap and warm water, adjacent to the place where the work is done.

5. In every factory to which this Order applies, and in which the total number of persons employed is 25 or more, the occupier shall provide, in readily accessible positions, "First Aid" boxes or cupboards in the proportion of at least one to every 150 persons.

The number of "First Aid" boxes or cupboards required under this provision shall be calculated on the largest number of persons employed at any one time, and any odd number of persons less than 150 shall be reckoned as 150.

Each "First Aid" box or cupboard shall contain at least:

(i) A supply of sterilized dressings, small, medium and large size, for fingers, hands, feet and other injured parts.

(ii) A supply of small and large burn dressings.

(iii) A supply of sterilised cotton wool.

(iv) A bottle of sal-volatile.

(v) A copy of the First Aid Leaflet issued by the Factory Department of the Home Office.

Each "First Aid" box or cupboard shall be distinctively marked, and if newly provided after the date of this Order shall be marked plainly with a white cross on a red ground.

Nothing except appliances or requisites for First Aid shall be kept in a "First Aid" box or cupboard.

Each "First Aid" box or cupboard shall be kept stocked and in good order, and shall be placed under the charge of a responsible person, who shall always be readily available during working hours.

A notice or notices shall be affixed in every workroom stating the name of the person in charge of the "First Aid" box or cupboard provided in respect of that room.

6. The occupier shall see that the Official Cautionary Notice as to the

effects of lemon and orange peeling on the skin is kept posted up in any part of the works in which any such process is carried on.

7. (i) All female workers whose work is done standing shall be provided with such facilities for sitting as will enable them to take advantage of any opportunities for resting which may occur in the course of their employment.

(ii) All persons engaged in fruit peeling, sorting, picking, and finishing and covering filled vessels shall be provided with seats so that they may do their work sitting. Such seats shall be properly adjusted to the work.

AERATED WATER

[A special licence is required to use a soda fountain in a shop.]

Duties of those engaged in the Manufacture of Aerated Waters

It shall be the duty of the employer to observe Part I of these Regulations.

It shall be the duty of every person employed to observe Part II of these Regulations.

PART I

Duties of Employers

1. All machines for filling bottles or syphons shall be so constructed, placed or fenced, as to prevent as far as possible a fragment of a bursting bottle or syphon from striking any person employed in the works.

2. The fittings of a filled syphon shall not be polished unless the syphon is held in a box or case so constructed as to prevent as far as possible the escape of fragments of a bursting syphon. Provided that this Regulation shall not apply in the case of syphons filled at a pressure of less than 130 lb. per square inch.

3. There shall be provided and maintained in good condition for the use of all persons engaged in filling bottles or syphons (*a*) suitable face guards to protect the face, neck and throat, and (*b*) suitable gauntlets for both arms to protect the whole hand and arm. Provided that (i) this Regulation shall not apply where bottles are filled by means of an automatic machine so constructed that no fragment of a bursting bottle can escape, and (ii) where a machine is so constructed that only one arm of the bottler at work upon it is exposed to danger, a gauntlet need not be provided for the arm which is not exposed to danger.

4. There shall be provided and maintained in good condition for the use of all persons engaged in corking, crowning, screwing, wiring, foiling, capsuling, sighting or labelling, and, on request by any person engaged in any other process for the use of such person, (*a*) suitable face guards to protect the face, neck and throat, and (*b*) suitable gauntlets for both arms to protect the arm and at least half of the palm and the space between the thumb and forefinger.

5. There shall be provided and maintained in good condition for the

use of all persons employed in any process involving exposure to wet, waterproof aprons with bibs and waterproof boots or clogs. Provided that where it is shown to the satisfaction of the Chief Inspector of Factories that the conditions of work in any factory or workshop are such as to render the use of waterproof boots and clogs unnecessary he may by certificate in writing exempt the occupier of such factory or workshop from the part of this Regulation requiring the provision of waterproof boots or clogs; and he may at his discretion revoke such certificate.

6.—(*a*) There shall be provided and maintained in readily accessible positions First Aid boxes or cupboards in the proportion of at least one to every hundred and fifty persons employed. Each First Aid box or cupboard shall be distinctively marked, and if newly provided after the date of these Regulations shall be marked plainly with a white cross on a red ground, and shall contain, besides any other medical appliances or requisites—

(i) A sufficient supply of sterilised dressings, small, medium and large size suitable for fingers, hands and other injured parts.

(ii) A supply of sterilised cotton wool.

(iii) Impermeable waterproof plaster.

(iv) A two per cent alcoholic solution of iodine, a bottle of sal volatile and a bottle of eye drops.

(v) A copy of the First Aid Leaflet issued by the Factory Department of the Home Office.

(*b*) Nothing except appliances or requisites for First Aid shall be kept in a First Aid box or cupboard.

(*c*) Each First Aid box or cupboard shall be kept stocked and in good order and shall be placed under the charge of a responsible person who shall always be readily available during working hours. A notice or notices shall be affixed in every workroom stating the name of the person in charge of the First Aid box or cupboard provided in respect of that room.

Part II

Duties of Persons Employed

7. All persons engaged in any of the processes named in Regulations 3 and 4 shall, while at work in these processes, wear the face guards and gauntlets provided in pursuance of these Regulations.

8. No person shall polish the fittings of a filled syphon unless it is held in a box or case constructed as required by Regulation 2, or unless the syphon has been filled at a pressure of less than 130 lb. per square inch.

9. All persons employed in any process involving exposure to wet shall, while at work, wear the protective clothing provided in pursuance of Regulation 5.

CHAPTER XVII

THE WORKMEN'S COMPENSATION ACT

What may be considered a continuation of the Factory Act, but almost overshadowing it in importance so far as both employers and workmen are concerned, is the "Workmen's Compensation Act, 1906". This Act came into operation on 1st July, 1907. It repealed all previous Workmen's Compensation Acts, and its scope is immensely broadened as compared with these, so that everyone who is employed for wages or salary, totalling less than £250 a year, or in the case of a man employed at manual labour for a remuneration above this amount, the employer is liable for compensation. The Act for the first time brings domestic servants within its scope. Compensation is to be paid to workmen for personal injury by accident "arising out of and in the course of the employment". This condition is one that readily lends itself to dispute as to what is and what is not "in the course of employment". A case was recently brought into court in which a servant engaged in sewing on her own behalf, but with the sanction of her employer, was injured in the eye by a bird which had flown in at the window, and which she had endeavoured to catch or chase out again. This was decided by the court as an injury not received in the course of her employment. The reasonable rendering of the stipulation is that the servant must be doing something directly connected with the employer's business or incidental to it specially.

Scope of the Act.

Extent of Liability.

The conditions governing the payment of compensation are set out in Section 1 as follows:—

"The employer shall not be liable under this Act in respect of any injury which does not disable the workman for a period of at least one week from earning full wages at the work at which he was employed.

"When the injury was caused by the personal negligence or wilful act of the employer or of some person for whose act or default the employer is responsible, nothing in this Act shall affect any civil liability of the employer, but in that case the workman may at his option either claim compensation under this Act or take proceedings independently of this Act; but the employer shall not be liable to pay compensation for injury to a workman by accident . . . both independently of and also under this Act, and shall not be liable to any proceedings independently of this Act, except in the case of such personal negligence or wilful act as aforesaid:

"If it is proved that the injury to a workman is attributable to the serious and wilful misconduct of that workman, any compensation claimed in respect of that injury shall, unless the injury results in death or serious and permanent disablement, be disallowed."

The all-embracing nature of the provisions of the Act is seen in the last subsection quoted, according to which even if a man's death or permanent

disablement while engaged in his employment is due to his own serious and wilful misconduct, the employer is nevertheless liable.

The scale of compensation, which is the serious part of the Act from the employer's point of view, is given in the first schedule attached to the Act.

Amount of Compensation.

"The amount of compensation under this Act shall be

"(*a*) where death results from the injury—

"(i) if the workman leaves any dependants wholly dependent upon his earnings, a sum equal to his earnings in the employment of the same employer during the three years next preceding the injury, or the sum of one hundred and fifty pounds, whichever of these sums is the larger, but not exceeding in any case three hundred pounds, provided that the amount of any weekly payments made under this Act, and any lump sum paid in redemption thereof, shall be deducted from such sum, and, if the period of the workman's employment by the said employer has been less than the said three years, then the amount of his earnings during the said three years shall be deemed to be one hundred and fifty-six times his average weekly earnings during the period of his actual employment under the said employer;

"(ii) if the workman does not leave any such dependants, but leaves any dependants in part dependent upon his earnings, such sum, not exceeding in any case the amount payable under the foregoing provisions, as may be agreed upon, or, in default of agreement, may be determined, on arbitration under this Act, to be reasonable and proportionate to the injury to the said dependants; and

"(iii) if he leaves no dependants, the reasonable expenses of his medical attendance and burial, not exceeding ten pounds;

"(*b*) where total or partial incapacity for work results from the injury, a weekly payment during the incapacity not exceeding fifty per cent of his average weekly earnings during the previous twelve months, if he has been so long employed, but if not then for any less period during which he has been in the employment of the same employer, such weekly payment not to exceed one pound."

"If the incapacity lasts less than two weeks no compensation shall be payable in respect of the first week; and as respects the weekly payments during total incapacity of a workman who is under twenty-one years of age at the date of the injury, and whose average weekly earnings are less than twenty shillings, one hundred per cent shall be substituted for fifty per cent of his average weekly earnings, but the weekly payment shall in no case exceed ten shillings."

Various Provisions.

If a man when partially disabled is able to earn wages, the amount of such wages is taken into account when the compensation for the accident causing partial disablement is settled. When a workman meets with an accident he must, if required, submit to medical examination as to the extent of the injury. A claim for compensation may be met by paying the amount into court pending a

settlement by the court, by agreement, or by arbitration. The question as to who is a dependant is to be settled by arbitration. If a workman refuses to be medically examined, his right to compensation may be suspended. When a weekly payment has been made to an injured workman for six months the employer may apply to have the weekly payments altered to a lump sum. If a workman leaves the United Kingdom he ceases to be entitled to compensation for injury unless proof is provided that the injury is permanent. "A weekly payment, or a sum paid by way of redemption thereof, shall not be capable of being assigned, charged, or attached, and shall not pass to any other person by operation of law, nor shall any claim be set off against the same."

Settlement of Disputes.

Disputes under the Act may be settled by arbitration of a committee representing employer and workmen, or if for any reason such a committee fails to settle the matter within six months it may then be settled by a single arbiter agreed to by both parties, or failing that by a County Court judge. In Scotland a dispute may be settled summarily in the Sheriff Court, and, unless on points of law, cannot be carried to the Court of Session. Should the parties or either of them disagree on the finding of the latter court, the appeal may be made to the House of Lords. In the case of Ireland the court for the settlement of cases may be that of the recorder of any city or town, with a reference in the case of disagreement to the Court of Appeal, then to the House of Lords.

Meaning of "Employer".

In this Act, as in many others, the utmost importance attaches to the "definitions". Thus "'Employer' includes any body of persons corporate or unincorporate and the legal personal representative of a deceased employer, and, where the services of a workman are temporarily lent or let on hire to another person by the person with whom the workman has entered into a contract of service or apprenticeship, the latter shall, for the purposes of this Act, be deemed to continue to be the employer of the workman whilst he is working for that other person". This definition seems to dispose of the fear which was expressed at the time of the passing of this Act that on account of the baker paying "pitch money" to millers' carmen, the latter might be considered as in the employ of the baker for the time being, and that in the event of an injury happening to the carman whilst carrying flour the baker might be liable for damages. The service of the carman with the miller is evidently continuous, and the miller does not at any time cease to be the employer. But in any case if the baker should give a miller's carman anything for carrying flour, it should be understood as strictly a gratuity and in no sense payment for services.

Meaning of "Workman".

This is the definition given of a workman:—"'Workman' does not include any person employed otherwise than by way of manual labour whose remuneration exceeds two hundred and fifty pounds a year, or a person whose employment is of a casual nature and who is employed otherwise than for the purposes of the employer's

trade or business, . . . or an outworker or a member of the employer's family dwelling in his house, but, save as aforesaid, means any person who has entered into or works under a contract of service or apprenticeship with an employer, whether by way of manual labour, clerical work, or otherwise, and whether the contract is expressed or implied, is oral or in writing."

Meaning of "Dependants".

The definition of dependants is as follows. "'Dependants' means such of the members of the workman's family as were wholly or in part dependent upon the earnings of the workman at the time of his death, or would but for the incapacity due to the accident have been so dependent, and where the workman, being the parent or grandparent of an illegitimate child, leaves such a child so dependent upon his earnings, or, being an illegitimate child, leaves a parent or grandparent so dependent upon his earnings, shall include such an illegitimate child and parent or grandparent respectively. 'Member of a family' means wife or husband, father, mother, grandfather, grandmother, stepfather, stepmother, son, daughter, grandson, granddaughter, stepson, stepdaughter, brother, sister, half brother, half sister."

Insurance.

The provisions of this Act are so far-reaching and the liabilities of even a small employer of labour so great, that but for the possibility of insurance against accidents coming under the Act the employer would be in constant danger of being ruined financially by accidents which he could neither guard against nor foresee. Fortunately the insurance companies have risen to the occasion, and their actuaries have estimated the risk carefully, while the competition amongst them has resulted in rates of premium so low that no employer, even if only of a domestic servant, should hesitate about taking out a policy of insurance to cover his risk under the Act, taking care, however, that the policy obtained properly covers the risks intended. Care should be taken that the policy makes allowance for engagement of extra labour with or without notice to the insuring company, and also allows for change of workmen or servants.

CHAPTER XVIII

MISCELLANEOUS ACTS

Employment of Children Act.

The Employment of Children Act, 1903, is of some importance to the baking and confectionery trades, not so much because the trade habitually employs children, but because at certain busy seasons of the year, such as Christmas, Good Friday, &c., youths under sixteen years of age—who come within the definition of children under the Act—are anxious to be allowed to work in a bakery in prohibited hours, and in certain light operations their services are helpful to the men, who on that account do not stop them from working. On the other hand, it is

a not uncommon practice with inspectors to watch bakeries and make raids at those special times, in the hope of securing convictions against employers, although well aware that the youths are not employed regularly or to an extent to do them any injury. The Act provides that a youth under fourteen years of age shall not be employed between nine in the evening and six in the morning unless under a local by-law, which may vary the hours for some specific occupations. A child is not to be employed to "lift, carry, or move anything so heavy as to be likely to cause injury to the child" A child is not to be employed in any occupation likely to be injurious to his life, limb, health, or education, regard being had to his physical condition. That an employer may know as to the condition of the youth, a letter from the local authority signed by a medical practitioner stating that the kind of occupation the youth is employed at is likely to be injurious, &c., is admissible as evidence in any subsequent proceedings against the employer. If the youth is employed not by the master but by an agent or workman only, and if the employer has actually given instructions prohibiting the employment of the youth or youths and has exercised due diligence to see that his instructions were attended to, then the agent or workman who actually allowed the employment can be sued by the inspector, instead of the employer. For obstructing an inspector in the discharge of his duty under this Act the penalty may be as high as twenty pounds.

The Truck Act.

The Truck Act, 1896, allows an employer to make certain regulations as to fines, but the regulations must be in the form of a specific contract, which must be contained in a notice kept fixed in such a position that it can always be seen and read; or the contract may be in writing signed by the workman. The contract must specify "the acts or omissions in respect of which the fine may be imposed, and the amount of the fine or the particulars from which that amount may be ascertained". The fine must be "in respect of some act or omission which causes or is likely to cause damage or loss to the employer, or interruption or hindrance to his business, and the amount of the fine must be fair and reasonable, having regard to all the circumstances of the case". No deductions can be made from wages unless under such a contract as described above, or unless particulars in writing are given to the workman showing the act or omission for which the fine or deduction is made, and the amount is to be supplied in this written statement on each occasion on which a deduction is made. Under the same set of conditions, but not otherwise, an employer is entitled to make a contract for deductions from wages, or fines for bad or negligent work, or injury to materials or other property of the employer. Under the same conditions also an arrangement may be made between an employer and workmen for deductions for the use of materials, machines, tools, standing room, light, heat, &c., but the amount charged in respect of these must not exceed the actual or estimated cost to the employer—must not, in fact, be more than a fair and reasonable rent or charge, having regard to all the circumstances of the case.

Any workman or shop assistant may recover from an employer any sum deducted contrary to the Act if proceedings are taken within six months; but where the workman has acquiesced in such deductions or payment, he can only recover the excess which has been deducted or paid over the amount, if any, which the court may find to have been fair and reasonable. A register of all deductions made in respect of contracts under this Act must be kept by the employer, and must be open for the inspection of the factory inspector.

Prevention of Corruption Act.

Some years ago, when the proposal was made to make punishable the giving or receiving of secret commissions, it was considered that any Act for the purpose would be of great use in connection with the baking and catering businesses, and might free these from some of the corrupt and secret bargains which were known to exist. Whilst the Prevention of Corruption Act, 1906, has made secret commission bargains still more secret than they had been before, and has caused greater caution in entering into such bargains, it can hardly be said to have been as effective in preventing the evil as was expected. This Act is very short. "If any agent corruptly accepts or obtains . . . from any person, for himself or for any other person, any gift or consideration as an inducement or reward for doing or forbearing to do . . . any act in relation to his principal's affairs or business, or for showing or forbearing to show favour or disfavour to any person in relation to his principal's affairs or business"; or if any person gives or offers gifts for the same purpose, . . . or "if any person knowingly gives to any agent, or if any agent knowingly uses with intent to deceive his principal any receipt, account, or other document in respect of which the principal is interested, and which contains any statement which is false or erroneous or defective in any material particular, and which to his knowledge is intended to mislead the principal", then for such offence the maximum penalty is two years' imprisonment with or without hard labour, or a fine not exceeding five hundred pounds, or to both fine and imprisonment. The number of cases brought into court under the Act has been so small as to indicate that the Act has practically been a failure.

Shop Hours Act.

Bakers have not to any great extent taken advantage of the Shop Hours Act, 1904, under which, on an application to the local authority, the latter, being satisfied that two-thirds of those engaged in a particular trade in a locality desire the authority to make a closing order respecting that trade, may make such an order. The hour fixed by a closing order may not be sooner than seven o'clock on any weekday, nor earlier than one o'clock on one day in the week. A closing order may prohibit, either absolutely or subject to such exemptions and conditions as may be contained in the order, the carrying on of any retail trade after the closing hour. The order may allow sales after the closing hour in cases of emergency, &c. Fairs and bazaars for charitable purposes are exempt from the application of closing orders, nor do they apply to any shop where the only trade carried on is post office, medicines, &c., sale by

retail of intoxicating liquors, &c., sale of refreshments for consumption on the premises, sale of tobacco, newspapers, &c.

When several trades are carried on in the same shop, and if one or more of these trades are those to which closing orders are locally applied, the shop can be kept open, but only on such terms and under such conditions as may be specified in the order. When a local authority makes a closing order with respect to any trade, this must be confirmed by the central authority, after which it has the force of an Act of Parliament. A closing order may be annulled by an Order in Council. If at any time the local authority is petitioned by a majority of any class of shops to which the closing order applies to amend or discontinue the order, the local authority may apply to the central authority, which may revoke the closing order either absolutely or as far as it affects any particular class of shop.

Shop Assistants.

Bakers' shops are under the same regulations with regard to employees as shops in general, and as females are mostly employed they come under the regulations of the Seats for Shop Assistants Act. In the Shop Hours Act it is stipulated that no "young person —a person under eighteen years of age—is allowed to be employed in or about a shop for more than seventy-four hours in a week, meal-times included". An abstract of the Act must be exhibited in a conspicuous part of the shop. The Seats Act says that in all rooms of a shop or other premises where goods are actually retailed to the public, and where female assistants are employed for this retailing, the employer carrying on business in such premises must provide seats behind the counter, or in such other position as may be suitable for the purpose; and such seats must be in the proportion of not less than one seat to every three female assistants employed in each room.

Sale of Food and Drugs Acts.

The Sale of Food and Drugs Acts, 1875 to 1899, are not of very great importance to the baker and confectioner, except to those who sell the manufactures of others in packets or bulk. The essence of the Acts is in the declarations that no person shall sell an article of food or a drug mixed with any ingredient injurious to health or intended fraudulently to increase its bulk, weight, or measure, or conceal its inferior quality, but substances with none of these effects may be mixed if at the time of sale a notice is given to the purchaser by a label distinctly and legibly written or printed on or with the article to the effect that the same is mixed. No one is allowed to sell any food from which anything has been abstracted to injure its quality or nature without making disclosure of the alteration. For using a label falsely describing an article the penalty may be £20.

Merchandise Marks Acts.

The Merchandise Marks Acts, 1887 and 1891, may be of importance to bakers and confectioners. To forge any trade mark; to falsely apply to any goods any trade mark or mark resembling such as to be calculated to deceive; to make any die, block, or machine for forging a trade mark; and to apply any false description to goods are offences under the Act. To sell or expose for sale anything with a false

trade description is an offence, unless the seller has taken all reasonable precautions against committing the offence and had no reason to suspect the genuineness of the trade mark. It is a mitigation of an offence committed unknowingly if the seller gives to the prosecutor all information in his power with respect to the person from whom he obtained the goods complained of.

There are many other Acts of Parliament that indirectly affect the trade, but not intimately enough to warrant special notice.

CHAPTER XIX

THE BREAD LAWS

The Bread Acts are frequently referred to as obsolete, yet their spirit still regulates the manner in which bread is made and sold. The Acts as now existing must be considered, not solely by themselves but in relation to all the Bread Acts that have gone before, and in relation also to the regulations regarding bread sale which obtain in other countries and in our own Colonies. As it is within possibility that, owing to agitation amongst bakers and amongst inspectors of weights and measures who have taken upon themselves to administer the Bread Acts, there may be an effort made within a few years to promote another Bread Bill, the important sections of the London Act still in force are given here. The general Act of 1836 applying to Scotland and England, and the Irish Act of 1838 are not given, as they are almost identical with the London Act of 1822; but a note is made of all the important differences.

The Bread Acts.

The great and essential difference between the present Acts and those preceding consists in the provision in Section III allowing the baker to make his bread of any weight and size he thinks fit. Previously the weight of all loaves sold and their price had been fixed by the magistrate. The change was brought about by the difficulty the magistrates had, in raising the price of bread in accordance with the market price of flour, to be just to the bakers on the one hand and to the public on the other; for the smallest increase or decrease of price on a two-pound loaf could not be less than a farthing, and that was the equivalent at that time of about 3*s.* 8*d.* on a sack of flour. But the price of flour was varying by amounts much less or more than this, and in any case seldom by 3*s.* 8*d.* or exact multiples of that sum, and so the bakers were constantly harassed by prices fixed too low by the magistrates. The evident purpose of the liberty allowed in the present Acts was to give the baker power to vary the weight of his loaves to meet small changes in the price of flour, while the interests of the public were to be conserved by the stipulation that all bread must be sold by weight and not otherwise. The trade is now divided into two opposing camps: one holding to the idea of the older

Mode of Selling.

Bread Acts that the weight of all loaves should be definitely fixed; the other that full advantage should be taken of the liberty allowed by the Acts as now in force. The provisions in the Act of 1836 as applied to Scotland are not actually in force in those cities or towns where the corporations have power to make special provisions and regulations for the sale of bread or other articles.

THE LONDON BREAD ACT, 1822

An Act to repeal the Acts now in force relating to Bread to be sold in the City of *London* and the Liberties thereof, and within the Weekly Bills of Mortality, and Ten Miles of the *Royal Exchange;* and to provide other Regulations for the Making and Sale of Bread, and preventing the Adulteration of Meal, Flour, and Bread, within the Limits aforesaid.

WHEREAS an Act was passed in the Fifty-fifth Year of the Reign of His late Majesty King *George* the Third, intituled *An Act to repeal the Acts now in force relating to Bread to be sold in the City of* London *and Liberties thereof, and within the Weekly Bills of Mortality, and Ten Miles of the* Royal Exchange, *and to prevent the Adulteration of Meal, Flour, and Bread, and to regulate the Weights of Bread within the same Limits:* And whereas an Act was passed in the Fifty-ninth Year of the Reign of His said late Majesty King *George* the Third, intituled *An Act to alter and amend an Act made in the Fifty-fifth Year of the Reign of His present Majesty, intituled* '*An Act to repeal the Acts now in force relating to Bread to be sold in the City of* London *and the Liberties thereof, and within the Weekly Bills of Mortality and Ten Miles of the* Royal 'Exchange, *and to prevent the Adulteration of Meal, Flour, and Bread, and to* '*regulate the Weights of Bread within the same limits;*' which said last-mentioned Act was, by another Act passed in the Sixtieth Year of His said late Majesty King *George* the Third, continued until the Twenty-fourth Day of *June* One thousand eight hundred and twenty: And whereas another Act was passed in the First Year of the Reign of His present Majesty, intituled *An Act to continue until the Twenty-fourth Day of* June *One thousand eight hundred and twenty-two, Two Acts of the Fifty-ninth and Sixtieth Years of His late Majesty, for regulating the Weight and Sale of Bread:* And whereas it is expedient that the said recited Acts of the Fifty-ninth and Sixtieth Years of the Reign of His said late Majesty, and of the First Year of the Reign of His present Majesty, should be continued until the Twenty-ninth Day of *September* next; and that from and after the said Twenty-ninth Day of *September* next, the said recited Act of the Fifty-fifth Year of the Reign of His said late Majesty, and the several Provisions therein contained, (except so much thereof as repeals any former Act or Acts) shall be altogether repealed; and that in lieu of the several Provisions and Penalties contained in that Act, and in the said recited Act of the Fifty-ninth Year of the Reign of His said late Majesty, the Regulations, Provisions, and Penalties hereinafter contained shall be substituted: But inasmuch as the Purposes aforesaid cannot be effected without the Aid and Authority of Parliament: May it therefore please Your Majesty that it may be enacted; and be it enacted by the King's most Excellent Majesty, by and with the Advice and Consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the Authority of the same, That the said recited Acts of the Fifty-ninth and Sixtieth Years of the Reign of His said late Majesty, and of the First Year of the Reign of his present Majesty, and the several Clauses and Provisions therein contained, shall be and the same are hereby con-

tinued, and shall remain and continue in force until the said Twenty-ninth Day of *September* next; and that from and after the said Twenty-ninth Day of *September*, the said recited Act of the Fifty-fifth Year of the Reign of His said late Majesty, and all and every the Provisions therein contained, (except so much thereof as repeals any former Act or Acts) shall be and the same are hereby repealed.

II. And be it further enacted, That it shall and may be lawful for the several Bakers or Sellers of Bread within the City of *London* and the Liberties thereof, within the Weekly Bills of Mortality, and within Ten Miles of the *Royal Exchange*, to make and sell, or offer for Sale, in his, her, or their Shop, or to deliver to his, her, or their Customer or Customers, Bread made of Flour, or Meal of Wheat, Barley, Rye, Oats, Buck Wheat, Indian Corn, Peas, Beans, Rice, or Potatoes, or any of them, and with any common Salt, pure Water, Eggs, Milk, Barm, Leaven, Potatoe, or other Yeast, and mixed in such Proportions as they shall think fit, and with no other Ingredient or Matter whatsoever, subject to the Regulations hereinafter contained.

Bread made of the Articles herein mentioned may be sold.

III. And be it further enacted, That it shall and may be lawful for the several Bakers or Sellers of Bread within the Limits aforesaid, to make and sell, or offer for Sale, in his, her, or their Shop, or to deliver to his, her, or their Customer or Customers, Bread made of such Weight or Size as such Bakers or Sellers of Bread shall think fit; any Law or Usage to the contrary notwithstanding.

Bakers to make Bread of any Weight or Size.

IV. And be it further enacted, That from and after the Commencement of this Act, all Bread sold within the Limits aforesaid, shall be sold by the several Bakers or Sellers of Bread respectively within the said Limits by Weight; and in case any Baker or Seller of Bread within the Limits aforesaid shall sell, or cause to be sold, Bread in any other Manner than by Weight, then and in such Case every such Baker or Seller of Bread shall, for every such Offence, forfeit and pay any Sum not exceeding Forty Shillings, which the Magistrate or Magistrates, Justice or Justices, before whom such Offender or Offenders shall be convicted, shall order and direct: Provided always, that nothing in this Act contained shall extend or be construed to extend to prevent or hinder any such Baker or Seller of Bread from selling Bread usually sold under the Denomination of French or Fancy Bread, or Rolls, without previously weighing the same.

Bread to be sold by Weight, and in no other Manner.

Not to extend to French or Fancy Bread, or Rolls.

V. And be it further enacted, That the several Bakers or Sellers of Bread respectively within the said Limits, in the Sale of Bread shall use the Avoirdupoise Weight of Sixteen Ounces to the Pound, according to the Standard in the Exchequer, and the several Gradations of the same for any less Quantity than a Pound; and in case any such Baker or Seller of Bread shall at any Time use any other than the Avoirdupoise Weight, and the several Gradations of the same, he, she, or they shall, for every such Offence, forfeit and pay any Sum not exceeding Five Pounds nor less than Forty Shillings, as the Magistrate or Magistrates, Justice or Justices, before whom such Conviction shall take place, shall from Time to Time order and adjudge.

Penalty on Bakers using any other Weight than Avoirdupoise Weight.

VII. And be it further enacted, That in case any such Baker or Seller of Bread shall at any Time before the Expiration of Two Years from the Commencement of this Act, sell or deliver in his, her, or their Shop, House, or Premises, any Bread which shall not have been previously weighed in the Presence of the Party purchasing the same, whether required by the Purchaser so to do or not, except as aforesaid, then and in every such Case every such Baker or Seller of Bread so offending, shall, upon Conviction in Manner

Penalty for selling Bread not previously weighed.

herein-after mentioned, forfeit and pay for every such Offence, any Sum not exceeding the Sum of Ten Shillings, as the Magistrate or Magistrates, Justice or Justices, before whom such Conviction shall take place, shall from Time to Time order and adjudge.

Bakers to provide in their Shops Beams, Scales, and Weights, &c., and to weigh Bread, &c.

VIII. And be it further enacted, That every Baker or Seller of Bread within the Limits aforesaid, shall cause to be fixed in some conspicuous Part of his, her, or their Shop, on or near the Counter, a Beam and Scales with proper Weights, or other sufficient Balance, in order that all Bread there sold may from Time to Time be weighed in the Presence of the Purchaser or Purchasers thereof, except as aforesaid; and in Case any such Baker or Seller of Bread shall neglect to fix such Beam and Scales, or other sufficient Balance, in manner aforesaid, or to provide and keep for use proper Beam and Scales and proper Weights or Balance, or shall have or use any incorrect or false Beam or Scales or Balance, or any false Weight not being of the Weight it purports to be, according to the Standard in the Exchequer, then and in every such Case, he, she, or they shall, for every such false Beam and Scales and Balance, or false Weight, forfeit and pay any Sum not exceeding Five Pounds, which the Magistrate or Magistrates, Justice or Justices, before whom such Offender or Offenders shall be convicted, shall order and direct.

Bakers and Sellers of Bread, and other Persons delivering by Cart, &c., to be provided with Beams, Scales, and Weights, &c., for weighing Bread.

IX. And be it further enacted, That every Baker or Seller of Bread within the Limits aforesaid, and every Journeyman, Servant, or other Person employed by such Baker or Seller of Bread, who shall convey or carry out Bread for Sale in any Cart or other Carriage, drawn by a Horse, Mule, or Ass, shall be provided with, and shall constantly carry in such Cart or other Carriage, a correct Beam and Scales with proper Weights, or other sufficient Balance, in order that all Bread sold by every such Baker or Seller of Bread, or by his or her Journeyman, Servant, or other Person, may from Time to Time be weighed in the Presence of the Purchaser or Purchasers thereof, except as aforesaid; and in case any such Baker or Seller of Bread, or his or her Journeyman, Servant, or other Person, shall at any Time carry out or deliver any Bread, without being provided with such Beam and Scales with proper Weights, or other sufficient Balance, or whose Weights shall be deficient in their due Weight according to the Standard in the Exchequer, or shall at any Time refuse to weigh any Bread purchased of him, her, or them, or delivered by his, her, or their Journeyman, Servant, or other Person, in the Presence of the Person or Persons purchasing or receiving the same; then and in every such Case every such Baker or Seller of Bread shall, for every such Offence, forfeit and pay any Sum not exceeding Five Pounds, which the Magistrate or Magistrates, Justice or Justices, before whom such Offender or Offenders shall be convicted, shall order and direct

Bread not to be adulterated.

X. And be it further enacted, That no Baker or other Person or Persons who shall make Bread for Sale within the Limits aforesaid, nor any Journeyman or other Servant of any such Baker or other Person, shall at any Time or Times, in the making of Bread for Sale within such Limits, use any Mixture or Ingredient whatsoever in the Making of such Bread, other than and except as herein-before mentioned, on any Account or under any Colour or Pretence whatsoever, upon Pain that every such Person, whether Master or Journeyman, Servant or other Person, who shall offend in the Premises, and shall be convicted of any such Offence, by the Oath, or in case of a Quaker, by Affirmation, of One or more credible Witness or Witnesses, or by his, her, or their own Confession, shall for every such Offence forfeit and pay any Sum not exceeding Ten Pounds nor less than Five Pounds, or in Default thereof shall, by Warrant under the Hand and Seal or Hands and Seals of

the Magistrate or Magistrates, Justice or Justices, before whom such Offender shall be convicted, be apprehended and committed to the House of Correction, or some Prison of the City, County, Borough, or Place where the Offence shall have been committed or the Offender or Offenders shall be apprehended, there to remain for any Time not exceeding Six Calendar Months from the Time of such Commitment, unless the Penalty shall be sooner paid, as any such Magistrate or Magistrates, Justice or Justices, shall think fit and order; and it shall be lawful for the Magistrate or Magistrates, Justice or Justices, before whom any such Offender or Offenders shall be convicted, to cause the Offender's Name, Place of Abode, and Offence, to be published in some Newspaper which shall be printed or published in or near the City of *London* or the Liberty of *Westminster*, and to defray the Expense of publishing the same out of the Money to be forfeited as last mentioned, in case any shall be so forfeited, paid, or recovered.

Names of Offenders to be published.

XI. And be it further enacted, That if any Person within the Limits aforesaid, shall put into any Corn, Meal, or Flour, which shall be ground, dressed, bolted, or manufactured for Sale within such Limits, either at the Time of grinding, dressing, bolting, or manufacturing the same, or at any other Time, any Ingredient or Mixture whatsoever, not being the real and genuine Produce of the Corn or Grain which shall be so ground; or if any Person shall, within the Limits aforesaid, knowingly sell, or offer or expose for Sale, either separately or mixed, any Meal or Flour of one Sort of Corn or Grain, as the Meal or Flour of any other Sort of Corn or Grain, or any Ingredient whatsoever mixed with the Meal or Flour so sold or offered or exposed for Sale; then and in every such Case every Person so offending shall, upon Conviction before any one or more Magistrate or Magistrates, Justice or Justices of the City, County, Borough, or Place where such Offence shall have been committed, on the Oath, or in case of a Quaker, by Affirmation, of One or more credible Witness or Witnesses, or by his, her, or their own Confession, forfeit and pay for every such Offence, any Sum not exceeding Twenty Pounds nor less than Five Pounds, which such Magistrate or Magistrates, Justice or Justices, before whom any such Offender or Offenders shall be convicted, shall think fit and order.

Corn, Meal, or Flour not to be adulterated, nor shall any Flour of one Sort of Corn be sold as the Flour of any other Sort.

XII. And be it further enacted, That every Person who shall make for Sale, or sell or expose for Sale, within the Limits aforesaid, any Bread, made wholly or partially of the Meal or Flour of any other Sort of Corn or Grain than Wheat, or of the Meal or Flour of any Peas or Beans, shall cause all such Bread to be marked with a large Roman M; and if any Person shall at any Time, within the Limits aforesaid, make or sell, or expose for Sale, any such Bread without such Mark as herein-before directed, then and in every such Case, every Person so offending shall, upon Conviction in Manner herein-after mentioned, forfeit and pay for every Pound Weight of such Bread, and so in Proportion for any less Quantity, which shall be so made for Sale or sold or exposed for Sale, without being so marked as aforesaid, any Sum not exceeding Ten Shillings, as the Magistrate or Magistrates, Justice or Justices, before whom such Conviction shall take place, shall from Time to Time order and adjudge.

Bread made of mixed Meal or Flour to be marked with a Roman M.

XIII. And be it further enacted, That it shall be lawful for any Magistrate or Magistrates, Justice or Justices of the Peace, within the Limits of their respective Jurisdictions, and also for any Peace Officer or Officers, authorized by Warrant under the Hand and Seal or Hands and Seals of any such Magistrate or Magistrates, Justice or Justices (and which Warrant any such Magistrate or Magistrates, Justice or Justices, is and are hereby

Magistrates or Peace Officers, by their Warrants, may search a Baker's Pre

mises, and if any adulterated Flour, Bread, &c., be found, the same may be seized and disposed of.

empowered to grant), at seasonable Times in the Day-time, to enter into any House, Mill, Shop, Stall, Bakehouse, Bolting House, Pastry Warehouse, Outhouse or Ground of or belonging to any Miller, Mealman, or Baker, or other Person who shall grind Grain, or dress or bolt Meal or Flour, or make Bread for Reward or Sale, within the Limits aforesaid, and to search or examine whether any Mixture or Ingredient not the genuine Produce of the Grain such Meal or Flour shall import or ought to be, shall have been mixed up with or put into any Meal or Flour in the Possession of such Miller, Mealman, or Baker, either in the grinding of any Grain at the Mill, or in the dressing, bolting, or manufacturing thereof, whereby the Purity of any Meal or Flour is or shall be in anywise adulterated; or whether any Mixture or Ingredient, other than is allowed by this Act, shall have been mixed up with or put into any Dough or Bread in the Possession of any such Baker or other Person, whereby any such Dough or Bread is or shall be in anywise adulterated; and also to search for any Mixture or Ingredient which may be intended to be used in or for any such Adulteration or Mixture; and if on any such Search, it shall appear that any such Meal, Flour, Dough, or Bread, so found, shall have been so adulterated by the Person in whose Possession it shall then be, or any Mixture or Ingredient shall be found, which shall seem to have been deposited there in order to be used in the Adulteration of Meal, Flour, or Bread; then and in every such Case, it shall be lawful for every such Magistrate or Magistrates, Justice or Justices of the Peace, or Officer or Officers authorized as aforesaid respectively, within the Limits of their respective Jurisdictions, to seize and take any Meal, Flour, Dough, or Bread which shall be found in any such Search, and deemed to have been adulterated, and all Ingredients and Mixtures which shall be found and deemed to have been used or intended to be used in or for any such Adulteration as aforesaid; and such part thereof as shall be seized by any Peace Officer or Officers authorized as aforesaid, shall, with all convenient Speed after Seizure, be carried to the nearest resident Magistrate or Magistrates, Justice or Justices of the Peace, within the Limits of whose Jurisdiction the same shall have been so seized; and if any Magistrate or Magistrates, Justice or Justices, who shall make any such Seizure in pursuance of this Act, or to whom anything so seized under the Authority of this Act shall be brought, shall adjudge that any such Meal, Flour, Dough, or Bread so seized shall have been adulterated by any Mixture or Ingredient put therein, other than is allowed by this Act, or shall adjudge that any Ingredient or Mixture so found as aforesaid shall have been deposited or kept where so found for the Purpose of adulterating Meal, Flour, or Bread; then and in any such Case, every such Magistrate or Magistrates, Justice or Justices of the Peace, is and are hereby required, within the Limits of their respective Jurisdictions, to dispose of the same as he or they, in his or their Discretion, shall from Time to Time think proper.

Penalty on Persons in whose House, Shop, or other Premises, Ingredients for the Adulteration of Meal or Bread shall be found.

XIV. And be it further enacted, That every Miller, Mealman, or Baker, within the Limits aforesaid, in whose House, Mill, Shop, Stall, Bakehouse, Bolting House, Pastry Warehouse, Outhouse, Ground, or Possession, any Ingredient or Mixture shall be found, which shall, after due Examination, be adjudged by any Magistrate or Magistrates, Justice or Justices of the Peace, to have been deposited there for the Purpose of being used in adulterating Meal, Flour, or Bread, shall, on being convicted of any such Offence, either by his, her, or their own Confession, or by the Oath, or in the case of a Quaker, by Affirmation, of One or more credible Witness or Witnesses, forfeit and pay, on every such Conviction, any Sum of Money not exceeding Ten Pounds nor less than Forty Shillings for the First Offence; Five Pounds

for the Second Offence, and Ten Pounds for every subsequent Offence; or in default of Payment thereof, shall, by Warrant under the Hand and Seal or Hands and Seals of the Magistrate or Magistrates, Justice or Justices, before whom such Offender shall be convicted, be apprehended and committed to the House of Correction, or some Prison of the City, County, or Place where the Offence shall have been committed, or the Offender or Offenders shall be apprehended, there to remain for any Time not exceeding Six Calendar Months from the Time of such Commitment, (unless the Penalty be sooner paid) as any such Magistrate or Magistrates, Justice or Justices, shall think fit and order; and it shall be lawful for the Magistrate or Magistrates, Justice or Justices, before whom any such Offender shall be convicted, to cause the Offender's Name, Place of Abode, and Offence, to be published in some Newspaper which shall be printed or published in or near the City of *London*, and to defray the Expense of publishing the same out of the Money to be forfeited as last mentioned, in case any shall be so forfeited, paid, or recovered.

Names of Offenders to be published.

XV. And be it further enacted, That if any Person or Persons shall wilfully obstruct or hinder any such Search as herein-before is authorized to be made, or the Seizure of any Meal, Flour, Dough, or Bread or of any Ingredient or Mixture which shall be found on any such Search, and deemed to have been lodged with an Intent to adulterate the Purity or Wholesomeness of any Meal, Flour, Dough, or Bread, or shall wilfully oppose or resist any such Search being made, or the carrying away any such Ingredient or Mixture as aforesaid, or any Meal, Flour, Dough, or Bread, which shall be seized as being adulterated, or as not being made pursuant to this Act, he, she, or they so doing or offending in any of the Cases last aforesaid, shall for every such Offence, on being convicted thereof, forfeit and pay such Sum, not exceeding Ten Pounds, as the Magistrate or Magistrates, Justice or Justices, before whom such Offender or Offenders shall be convicted, shall think fit and order: Provided also, that if any Person making or who shall make Bread for Sale within the Limits aforesaid, shall at any Time make Complaint to any Magistrate or Magistrates, Justice or Justices of the Peace, within his or their Jurisdiction, and make appear to him or them, by the Oath, or in the case of a Quaker, by Affirmation, of any credible Witness, that any Offence which such Person shall have been charged with, and for which he or she shall have incurred and paid any Penalty under this Act, shall have been occasioned by or through the wilful Act, Neglect, or Default of any Journeyman or other Servant employed by or under such Person so making Complaint, then and in any such Case, any such Magistrate or Magistrates, Justice or Justices, may and is or are hereby required to issue out his or their Warrant, under his or their Hand and Seal, or respective Hands and Seals, for bringing any such Journeyman or Servant before any such Magistrate or Magistrates, Justice or Justices, or any Magistrate or Justice of the Peace acting in and for the City, County, Division, or Place where the Offender can be found, and on any such Journeyman or Servant being thereupon apprehended and brought before any such Magistrate or Magistrates, Justice or Justices, he or they, within his or their respective Jurisdiction, is and are hereby authorized and required to examine into the Matter of such Complaint, and on Proof thereof upon Oath or Affirmation to the Satisfaction of any such Magistrate or Magistrates, Justice or Justices of the Peace, who shall hear such Complaint, then any such Magistrate or Magistrates, Justice or Justices is and are hereby directed and authorized, by any Order under his or their respective Hand or Hands, to adjudge and order what reasonable Sum of Money shall be paid by any

Penalty for obstructing any Search authorized by this Act.

Offences occasioned by the wilful Default of Journeymen and Servants, how to be punished.

such Journeyman or Servant to his Master or Mistress, as or by way of Recompence to him or her for the Money he or she shall have paid by reason of the wilful Act, Neglect, or Default of any such Journeyman or Servant; and if any such Journeyman or Servant shall neglect or refuse, on his Conviction, to make immediate Payment of the Sum of Money which any such Magistrate or Magistrates, Justice or Justices, shall order him to pay by reason of such his said wilful Neglect or Default, then any such Magistrate or Magistrates, Justice or Justices, within his or their respective Jurisdiction, is or are hereby authorized and required, by Warrant under his or their Hand and Seal, or Hands and Seals, to cause such Journeyman or Servant to be apprehended and committed to the House of Correction, or some other Prison of the City, County, Division, or Place, in which such Journeyman or Servant shall be apprehended or convicted, to be kept there to hard Labour to any Term not exceeding Six Calendar Months from the Time of such Commitment, as to such Magistrate or Magistrates, Justice or Justices, shall seem reasonable, unless Payment shall be made of the Money ordered after such Commitment, and before the Expiration of the said Term of Six Months.

Bakers shall not bake Bread or Rolls on the Lord's Day,

nor sell Bread, nor bake Pies, &c., except between certain Hours.

XVI. Provided always, and be it further enacted, That no Master, Mistress, Journeyman, or other Person respectively, exercised or employed in the Trade or Calling of a Baker within the Limits aforesaid, shall, on the Lord's Day, or on any Part thereof, make or bake any Bread, Rolls, or Cakes of any Sort or Kind; or shall, on any other Part of the said Day than between the Hours of Nine of the Clock in the Forenoon and One of the Clock in the Afternoon, on any Pretence whatsoever, sell or expose to Sale, or permit or suffer to be sold or exposed to Sale, any Bread, Rolls, or Cakes, of any Sort or Kind; or bake or deliver, or permit or suffer to be baked or delivered, any Meat, Pudding, Pie, Tart, or Victuals, except as herein-after is excepted, or in any other Manner exercise the Trade or Calling of a Baker, or be engaged or employed in the Business or Occupation thereof, save and except so far as may be necessary in setting and superintending the Sponge to prepare the Bread or Dough for the following Day's Baking; and every Person offending against the last-mentioned Regulations, or any One or more of them, or making any Sale or Delivery hereby allowed otherwise than within the Bakehouse or Shop, and being thereof convicted before any Justice of the Peace of the City, County, or Place where the Offence shall be committed, within Six Days from the Commission thereof, either upon the View of such Justice, or on Confession by the Party, or Proof by One or more credible Witness or Witnesses upon Oath or Affirmation, shall for every such Offence pay and undergo the Forfeiture, Penalty, and Punishment herein-after mentioned; (that is to say), for the First Offence the Penalty of Ten Shillings; for the Second Offence the Penalty of Twenty Shillings; and for the Third and every subsequent Offence respectively the Penalty of Forty Shillings; and shall moreover, upon every such Conviction, bear and pay the Costs and Expences of the Prosecution, such Costs and Expences to be assessed, settled, and ascertained by the Justice convicting, and the Amount thereof, together with such Part of the Penalty as such Justice shall think proper to be allowed to the Prosecutor or Prosecutors for Loss of Time in instituting and following up the Prosecution, at a Rate not exceeding Three Shillings *per* Diem, and to be paid to the Prosecutor or Prosecutors for his, her, and their own Use and Benefit, and the Residue of such Penalty to be paid to such Justice, and within Seven Days after his Receipt thereof to be transmitted by him to the Churchwardens or Overseers of the Parish or Parishes where the Offence shall be committed, to be applied for the Benefit

of the Poor thereof; and in case the whole Amount of the Penalty, and of the Costs and Expences aforesaid, be not forthwith paid after Conviction of the Offender or Offenders, such Justice shall and may, by Warrant under his Hand and Seal, direct the same to be raised and levied by Distress and Sale of the Goods and Chattels of the Offender or Offenders; and in Default or Insufficiency of such Distress, commit the Offender or Offenders to the House of Correction, on a First Offence for the Space of Seven Days, for a Second Offence for the Space of Fourteen Days, and on a Third or any subsequent Offence for the Space of One Month, unless the Whole of the Penalty, Costs, and Expences be sooner paid and discharged: Provided nevertheless, that it shall be lawful for every Master or Mistress Baker, residing within the Limits aforesaid, to deliver to his or her Customers, on the Lord's Day, any Bakings until Half an Hour past One of the Clock in the Afternoon of that Day, without incurring or being liable to any of the Penalties in this Act contained.

Bakings may be delivered till Half-past One on Sundays.

XVII. Provided always, and be it further enacted, That no Person who shall follow or be concerned in the Business of a Miller, Mealman, or Baker, shall be capable of acting or shall be allowed to act as a Justice of the Peace under this Act, or in putting in Execution any of the Powers in or by this Act granted; and if any Miller, Mealman, or Baker shall presume so to do, he or they so offending in the Premises shall, for every such Offence, forfeit and pay the Sum of One hundred Pounds, to any Person or Persons who will inform or sue for the same, to be recovered, together with full Costs of Suit, in any of His Majesty's Courts of Record at *Westminster*, by Action of Debt, Bill, Plaint or Information, wherein no Essoign, Wager of Law, or more than One Imparlance, shall be allowed.

No Miller, Mealman, or Baker to act as a Justice of Peace in the Execution of this Act on Penalty of £100.

XXXI. Provided also, and be it further enacted, That no Person shall be convicted of any Offence under this Act, unless the Complaint is made within Forty-eight Hours after the Offence shall have been committed, except in Cases of Perjury; and that no Person who shall be prosecuted to Conviction for any Offence done or committed against this Act, shall be liable to be prosecuted for the same Offence under any other Law.

Limiting Time of Information.

The General Act of 1836, applicable to Scotland and provincial England, is substantially identical with the above. The Irish Act differs in a few small points. The Irish Act differs from the English in Section V with regard to penalties. In the English Act the penalties under this section are "not exceeding five pounds nor less than forty shillings"; in the Irish Act the penalties are "not exceeding forty shillings nor less than ten shillings".

Special Provisions of the Irish Bread Act.

In Section VI of the English Act, bread sellers are required to keep beam and scales, &c., in a conspicuous place in their shops, "in order that all bread there sold may from time to time be weighed in the presence of the purchaser"; but there is no penalty fixed for not weighing, although a maximum of five pounds is fixed for having no scales or false scales. In the Irish Act the same stipulation is made with regard to keeping the beam and scales, &c., in a conspicuous part of the shop; but the bread there need not be weighed unless required by the purchaser—"in order that every person who may purchase any such bread may, *if he or she shall think proper*, require the same to be weighed in his or her presence". In this Act there is a penalty for not having the scales or having incorrect scales,

&c., of a maximum of five pounds; but the same penalty is also provided if the sellers, "when thereunto required by any person who may purchase any such bread, refuse to weigh the same in the presence of such person, &c.". In the English Act Section VII requires bread sellers to carry scales and weights to weigh bread from time to time. This requirement is entirely omitted from the Irish Act.

In Section VII of the English Act, dealing with mixtures used in bread as allowed in Section IX, the penalties are fixed as a "sum not exceeding ten pounds nor less than five pounds". In the Irish Act, for the same offence the penalties are stated as "not exceeding five pounds nor less than fifty shillings"; and while the offending English or Scottish baker (unless the latter is under a local Act) is in default to be kept in prison "not exceeding six calendar months with or without hard labour", the Irish baker who offends can be incarcerated for only three months. In both Acts the stipulation is made that a conviction is to be published in the local newspaper where the offence has been committed, and the expense of publishing is to be paid out of the penalty paid by the baker; but in the Irish Act there is a special provision not in the English one, that the "Proprietor, Printer and Printers, and every other person or persons concerned therein are authorized to print and publish the same when required to do so by the order of the Magistrate, &c., and he, or she, or they, are . . . indemnified from any prosecution . . . by or from any person or persons whomsoever, any law, statute, or usage to the contrary thereof in anywise notwithstanding".

In the English Act the mere act of putting into the meal, flour, &c., any substance, "not being the real and genuine produce of the corn or grain, . . . or any meal or flour of one sort of grain as the meal or flour of any other sort", is an offence punishable with a fine of twenty pounds. In the Irish Act the offence is stated more precisely: if anyone mixes "any ingredient or mixture whatsoever, not being the real and genuine produce of the grain, . . . or if any person in Ireland shall knowingly sell, &c., . . . either separately or mixed, any corn, meal, or flour which shall not be equal or superior in quality or goodness to the sample purporting to be a sample of such corn, &c., . . . and produced by the owner . . . or other person selling or exposing or offering the same for sale to the view of the buyer, . . . or shall use or practice any fraud, covin, or deceit by which such corn, meal, or flour shall be made or rendered of *greater weight* than the same respectively would have been in case such mixture, fraud, covin, or deceit had not been practiced". The Irish fines are "not exceeding ten pounds nor less than forty shillings", and the meal, flour, &c., is to be forfeited, one moiety to go to the poor of the parish and one part to the informer.

In the English Act a complaint must be lodged within forty-eight hours from the time the offence had been committed; in the Irish Act fourteen days is allowed in which to lodge the complaint. With the exception of the differences mentioned above, the English and Irish Acts are in all respects practically alike.

In the London Act of 1822, Section VI prohibits the use of the terms quartern, peck, &c., but this stipulation is omitted from the other Acts: "during the space of two years from the commencement of this Act (1822) (it shall not be lawful) to make and sell or offer for sale . . . any loaf or loaves of the description or denomination of the peck, half peck, or quarter of a peck loaf or loaves, or any or either of them". The penalty for the offence is forty shillings.

Section VII of the London Act is also exclusive. It makes it compulsory "*before the expiration of two years from the commencement of this Act* to weigh every loaf sold in his shop, house, or premises in the presence of the party purchasing the same, whether required by the purchaser so to do or not". This provision, although at first limited to two years, is no doubt responsible for the shop custom prevalent still in London, but hardly anywhere else, of weighing bread at the time of sale.

The London Act in Section IX makes provision for carrying scales and weights in any cart or carriage "drawn by a horse, mule, or ass". The other Acts do not stipulate how the cart or carriage is to be drawn. The London Act in Section XVI contains stipulations limiting the kind of work bakers are allowed to do on Sunday. This provision is not stated in the other Acts.

The Quartern Loaf.

One of the strange things about the Bread Laws and their administration is that they have never been regarded with strictness by the trade, nor have they ever been administered by those who have taken this work upon them in the spirit of the statutes. In spite of the provision that for two years after the passing of the London Act loaves should not be sold by denomination of quartern, &c., this name still survives, but has now come to be considered as representing, in the case of the quartern, a four-pound loaf. At the time when the term "quartern" had statutory sanction it represented a loaf weighing 2 lb. 5½ oz. and was the quarter of a peck loaf, which the assize law had definitely fixed at 17 lb. 6 oz. The understanding was that twenty such peck loaves could be made from a sack of flour weighing 280 lb., so that the peck of flour was 14 lb. Some men are under the impression that the quartern is to represent a quarter of a stone avoirdupois weight, but it is really based as noted on the English corn or dry measure, in which two pints are one quart, four quarts one gallon, two gallons one peck, four pecks one bushel, and eight bushels one quarter. The method of selling bread by the gallon still obtains in many districts in the south of England, although the old statutes designated this size of loaf as a half peck. The old statutes did not require such a high yield of bread as now obtains, because flour being from home-grown wheat was much softer than it is now. Twenty peck loaves would only be about 347 lb. of bread, while 94 four-pound loaves amount to 376 lb. of bread. If there was any relation between the old statute quartern and the new one which custom has to some extent determined, the new should weigh a little over 4 lb. 9 oz., because there are still 20 pecks or 80 quarter-pecks in the sack of

flour. But the law, both London and provincial, distinctly specifies that "the avoirdupois weight of sixteen ounces to the pound and the several gradations thereof" is only to be used in the sale of bread, the mention of gradations of a pound clearly indicating that the statute did not intend that bakers must keep to even pounds or multiples of a pound, but rather that they should graduate the weight of their loaves by ounces or other convenient fractions of a pound. This has been recognized in Yorkshire and the north of England generally, and in many parts of the south and west of Ireland; but generally the practice has been to keep to even pounds as in the days when an assize was set, although even under that system bread could be sold, if the baker elected to sell it that way and not otherwise, at a constant price all the time, but varying the weight of the loaf in accordance with the market price of flour. This was called "Assize Bread" as distinguished from that sold by "Peck", "Half Peck", and "Quartern", which was called "Priced Bread". The weights of the one and the price of the other were always set by the magistrates who made the assize at the same time and according to a definite plan. An actual copy of one of the last assize tables set in use at the end of the eighteenth century is given as an appendix, and will show the relation of "assize" and "priced" bread and of wheaten and household bread. The "explanation" accompanying the table is that published with the table when it was in force.

Assize Bread.

The Bread Acts now in force contain no instructions for any official person authorized to institute proceedings against offenders. Their administration was practically left to the initiative of anyone who cared to take up the rôle of common informer, the reward of such a one for his trouble and ingenuity in securing convictions being a substantial share of the fines. When the Act was newly passed it was quite an occupation with some men to travel from town to town spying on bakers and acting as common informers, in the meantime making a living from their share of the fines. Within the last twenty or twenty-five years prosecutions under the Bread Acts have been mostly undertaken by inspectors of weights and measures. The requirement that bakers in Britain must carry scales and weights in vehicles used for bread delivery has given inspectors power to demand to see those scales and weights, and to ascertain whether they are properly adjusted; but the Bread Laws give the inspectors no power to demand that the bread shall be weighed unless they are the actual purchasers of the loaves. They have, of course, the status of common informers under the Acts, and as such can institute proceedings. The trade in many localities does not seem aware of the status and powers of the weights and measures inspectors in this matter, and some of those gentlemen, relying on the ignorance of the bakers concerning the law, and on the common fear of anything official, are in the habit of acting as though the Bread Act required the baker to weigh all his loaves two pounds only, and as though the whole power of administering the

Prosecutions under the Bread Acts.

Act were vested in the inspectors. Thus in some districts it is a common occurrence for the inspector to stop a baker's cart in the roadway and not only ask for the production of the scales and weights, which is within his right, but also demand that the majority of the loaves in the cart or van be weighed, although he makes no purchase. It is not always good policy even to appear to obstruct an inspector when he is over-zealous and oversteps his authority in a matter of this kind, but the baker would be perfectly within his legal right in refusing to weigh one loaf at the bidding of an inspector unless the latter purchased the loaf or as many as he desired weighed. Besides, there is no compulsion on the baker to sell bread to an inspector if it is inconvenient to do so. In any case, when a loaf is sold it should be at least the weight it purports to be, and should not be sold on the wide and general assumption that it is a two-pound loaf. Inspectors are not very guilty of asking for a two-pound loaf as they ought to ask if that is the weight they want, but with a view to catching the baker in what may be only a technical offence they ask simply for a loaf. The delivery men should be carefully instructed not to sell loaves in such circumstances without stating the weight they purport to be, and the guarantee given by the seller at the time of sale should be of a weight low enough to include the lightest loaf, although this guarantee may be less than the actual weight of the majority of the loaves. If the baker is precise in declaring the minimum weight he guarantees his loaves to be, and if the actual weight at the time of sale is up to or over that minimum, this has been recognized by the higher courts as proper compliance with the law as to "selling bread by weight".

The Problem of Fixed Weights.

Probably the majority of inspectors of weights and measures are in favour of a return to absolutely fixed weights for bread, allowing the baker to alter his price to suit the market price of flour. This system was in force under the Assize Laws, and virtually broke down because magistrates in setting the price of bread could not always, or indeed often, fix that price in accordance with the market price of flour. If loaves must weigh two pounds, and the smallest alteration in the price of a loaf of this size cannot be less than a farthing, an alteration by that amount is equivalent to an alteration in flour prices of about 4s. per sack. But flour may not vary by so much as this for years, with the result that the public—only because of this method of selling bread—have either to pay more than the proper price for their bread, or the baker has to be content with less than his fair profit. This difficulty was constantly before the magistrates when they had the duty of setting the price, and they not infrequently settled it in favour of the public to the detriment of the baker. The same difficulty still confronts the Master Bakers' Associations when they attempt to deal with the price of bread, and in the war of competition which is now so intense the price is still very often settled in favour of the public. The tendency to do this is much increased by the fact that there are, in large towns

especially, one or more considerable firms who remain outside the local associations and refuse to be ruled by them; and these firms not infrequently take the opportunity, when flour prices are rising and they have a quantity bought forward, to increase their activity, and by keeping prices down, or by selling under their neighbours, to increase considerably the amount of their business; on the other hand, when obdurate bakers are free from stocks in a falling market they may drop the price of bread long before it is profitably possible. As long as there is such a large margin as 4*s.* between the prices of flour, warranting a change in the price of bread, this kind of unfair competition will always be possible and more or less effective. Those bakers who cannot bear the strain of it are forced either to lose money directly or to reduce the quality of their bread and probably reduce their trade. The London County Council in the beginning of 1905 made an attempt to get a new Bread Bill passed which would have perpetuated and given statutory sanction to the unsatisfactory condition of things explained above; but by the vigorous action of the trade, which pointed out the difficulties confronting the baker if he had to adhere rigidly to fixed weights, the preamble of the Bill was found not proved. This Bill proposed to fix the weight of loaves at one pound or a complete number of pounds; to make all bread plain bread unless it weighed less than one pound; to give inspectors power of search and power to weigh loaves anywhere and everywhere; to give the power of administering the Act into the hands of the City authorities and of the London County Council; and to take all the fines into the coffers of these bodies.

The Bread Bill of 1905.

When the Government, during the war in 1917, took control of all wheat and flour supplies and appointed Lord Devonport as first Food Controller, one of his first official acts was to issue an Order that bread should only be made in 1 lb. sizes or an even number of pounds, and heavy penalties were imposed on bakers who might contravene this Order. Officials were given power of entry to bakers' premises to weigh loaves as they desired without purchasing, with like powers regarding loaves in delivery vehicles. This Order was in effect a complete abrogation of the Bread Acts (which are not repealed). When Lord Rhondda was appointed Food Controller, within six months after the office had been created, he found the regulation working unjustly to the baker, because some inspectors were prosecuting if only one loaf was short weight, and adding shortages of all single loaves to make a large aggregate shortage, but giving the baker no credit on the other side for loaves that might be overweight. Lord Rhondda, to remove this hardship, issued instructions that prosecutions should not be undertaken except on an average shortage of six loaves. These Orders were issued under the "Defence of the Realm Act" (referred to colloquially as DORA). When the war ceased, and after 1921 the most of the Dora regulations had been repealed, this one, at the instance of the Weights and Measures Inspectors, was retained. Although the whole matter had been carefully gone into in 1914 by a Select

Committee of the House of Commons, and their report (given on p. 226) was only awaiting consideration, the inspectors succeeded by representations to the Government in getting an Inter-Departmental Committee appointed, ostensibly to investigate the matter anew. This Committee consisted of some members of the Food Control Department, a few members of Parliament with no special knowledge on the subject, and the Chief Inspector of Weights and Measures of the London County Council. As this gentleman and his department were the chief promoters of the agitation for the continuance of the Dora regulations, which were in most respects identical with the Bill they had promoted in 1905, the baking trade, through the National Association of Master Bakers, protested against this official sitting as a member of the Committee, or, alternatively, asked that the bakers should also have a member on the Committee. Protest and proposal were rejected. The report of this Committee (given on p. 227) was exactly in accordance with the provisions suggested by the London County Council. Ostensibly on the strength of this report, but studiously ignoring the recommendations of the Select Committee of 1914, the Government introduced a Bill in 1922 (given on p. 227) to give effect to the Inter-Departmental Committee's report. In many particulars this Bill went very much farther than the Committee had suggested, including Scotland in the new regulations. The opposition of the baking trade became so intense that the Government withdrew the Bill. But on account of official pressure the war-time regulation fixing rigidly the weight of loaves was continued under the "Expiring Laws Continuation Act" until September, 1923.

Inter-Departmental Committee's Report.

The opposition is somewhat weakened by differences of opinion in different districts. In London, among the larger firms, the opinion is held that it is better to take the chance of profit accruing from variations of flour prices than to give competitors an opportunity of changing the weights of loaves to meet these variations. Many bakers in Birmingham and the Midlands favour having the weight fixed by statute, or by regulations framed locally by organized bakers in conjunction with the authorities; these regulations to be given the force of statutory enactments. At the time of writing, a compromise between rival schemes has been suggested in a statement issued by the County Councils Association, which is composed of officials and members of Municipal and County Corporations, on whom would devolve the duties of carrying out any new regulations. These suggestions follow closely the Report of the Select Committee on Short Weight of 1914 (p. 226). They are generally accepted by the whole English trade. The Scottish trade objects to being included in any regulations applicable to England, and contends that the Scottish custom is amply justified by experience and general acceptance. Ireland is now excluded from any bread sale regulations made by the British Parliament.

Rival Schemes.

THE RECOMMENDATIONS OF THE GOVERNMENT'S SELECT COMMITTEE ON SHORT WEIGHT, 1914

(i) The Bread Acts of 1822 and 1836 to be repealed and a new Act applicable to the whole of England and Wales to be passed, re-enacting the existing law that bread should be sold by weight only.

(ii) An obligation to be laid on Local Authorities who appoint inspectors under the Weights and Measures Acts to administer the Bread Act.

(iii) "Fancy Bread" to be defined, and to be exempt from the operation of the Act.

(iv) All bread, when sold over the counter, to be in parcels of one pound or multiples of one pound, or the actual weight of such bread to be then and there ascertained by weighing, and declared to the purchaser.

(v) All bread sold outside the shop to be sold either—

(*a*) In parcels of one pound or multiples of one pound, or

(*b*) At a weight already guaranteed to the purchaser orally or by written or printed notice in the following form:—

The bread (or, each loaf) sold with this notice is guaranteed to weigh at least lb. oz. The purchaser is entitled to have the bread weighed on delivery and to be informed of the exact weight of each loaf or parcel of bread delivered.

(vi) Paragraphs (iv) and (v) above not to apply to bread which is less than one pound in weight cut from a loaf, or when slices are demanded, or to bread supplied under contract to hospitals, asylums, infirmaries, or other public institutions, hotels, or restaurants, when the contract provides that the quantity supplied is to be ascertained by weighing on delivery and the bread is for consumption within such institutions, hotels, or restaurants.

(vii) Persons selling or delivering bread, whether in or outside the shop, to be obliged to provide proper weights and scales.

(viii) That any sale of bread of any less weight than one pound or a multiple of one pound, or of less weight than that guaranteed, as the case may be, should render the seller liable to a penalty for the sale of short-weight bread; provided that no conviction should take place in respect of the short weight of a single loaf, but on the average of not fewer than three loaves.

(ix) That inspectors under the Act may be empowered to purchase any bread which is on sale, or exposed for sale, or which is being carried for delivery, and when a loaf has been purchased, to weigh two other loaves to be selected by the inspector, in order to carry out the proviso in paragraph (viii), and that it shall be an offence for a baker or his servant to refuse to sell to an inspector any bread which is on sale or to refuse to allow him to test the weight of two other loaves.

(x) That increased penalties should be prescribed for offences subsequent to the first.

(xi) The limit of 48 hours fixed by the existing Acts for laying informations before Justices to be increased to 28 days; provided that the baker or seller be informed of the fact that an inspection has been made, either at the time of the inspection or reasonably soon after the inspection—as a condition precedent to any subsequent proceedings which may be set on foot.

(xii) A provision to be enacted similar to that contained in Section 5 of the Margarine Act, 1897, and Section 6 of the Employment of Children Act, 1903, and Section 6 of the Shop Hours Act, 1892, empowering a defendant to lay an information against his servant, and to be discharged if he prove that his servant is at fault.

THE RECOMMENDATIONS OF THE MINISTRY OF FOOD INTER-DEPARTMENTAL COMMITTEE, 1921.

(i) The Bread Acts of 1822 and 1836 to be repealed and a new Act applicable only to England and Wales to be passed, re-enacting that all bread (other than bread sold for consumption on the premises of the seller) shall be sold by weight, and not otherwise, subject to the proviso mentioned in paragraph (iii) below.

(ii) An obligation to be laid on Local Authorities who appoint inspectors under the Weights and Measures Acts to administer the Bread Act, the provisions of which are herein recommended, and the Board of Trade to be given power to make instructions and regulations for the guidance of inspectors.

(iii) Fancy Bread and bread in loaves or rolls weighing 12 oz. or under to be exempt from the operation of the Act.

(iv) No loaf of bread to be sold unless its weight be 1 lb. or a simple multiple of 1 lb.

The custom in Scotland is to have this weight stamped on the loaf, and the Committee recommend that this point might be considered with reference to England and Wales.

(v) Paragraph (iv) above not to apply to bread supplied under contract to hospitals, asylums, or other public institutions, hotels or restaurants when the contract provides that the quantity supplied is to be ascertained by weighing on delivery, and the bread is for consumption within such institutions, hotels, or restaurants.

(vi) The legal procedure under the new Bread Act to be brought in accordance with that under the Weights and Measures Acts and the Summary Jurisdiction Acts. Section 56 of the Weights and Measures Act of 1878 and Section 14 of the Weights and Measures Act of 1904 to be made specially applicable.

(vii) The baker or seller of bread to be informed of the fact that an inspection has been made and of the result of such inspection, either at the time of the inspection or reasonably soon after the inspection, as a condition precedent to any subsequent proceedings which may be set on foot.

(viii) Severer penalties than the penalties specified in the Bread Acts to be imposed for offences, especially for offences subsequent to the Act, provided that no conviction takes place in respect of the short weight of a single loaf.

SALE OF BREAD BILL

To provide for the better protection of the public in relation to the sale of bread

Be it enacted by the King's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

1.—(1) A person shall not, either by himself or by any servant or agent, sell or offer for sale any bread otherwise than by weight, except in the case of bread sold or offered for sale for consumption on the premises of the seller.

(2) A person shall not, either by himself or by any servant or agent, sell, or have in his possession for sale, or deliver under a contract of sale, any loaf of bread unless its weight be one pound or an integral number of pounds:

Provided that this sub-section shall not prevent the sale, possession, or delivery of a loaf purporting to be of a permitted weight, but in fact exceeding that weight.

(3) If any person acts in contravention of this section he shall be liable on summary conviction to a fine not exceeding, in the case of a first offence five pounds, in the case of a second offence fifty pounds, and in the case of a third or subsequent offence one hundred pounds.

(4) A prosecution in respect of an offence under this section shall not be instituted after the expiration of twenty-eight days from the time when the offence was committed, nor unless the defendant has within seven days after the alleged commission of the offence been informed in writing of the intention to prosecute, and of the date and nature of the alleged offence.

(5) The provisions of this section shall not apply to fancy bread or to loaves not exceeding twelve ounces in weight.

2.—(1) Every person selling, offering or exposing for sale by retail any bread, shall provide and keep in some conspicuous part of his shop or premises, on or near the counter, a correct weighing instrument of a pattern suitable for weighing bread, and every person who carries bread in any horse-drawn or motor vehicle for sale or delivery to a purchaser, shall carry with such vehicle a correct weighing instrument as aforesaid.

(2) Every person selling, offering or exposing for sale by retail any bread, or carrying bread in any such vehicle for sale or delivery to a purchaser, shall, if so requested by the purchaser or any person on his behalf or by any person duly authorised in that behalf by a local authority, weigh the bread in the presence of such purchaser or other person, or permit such purchaser or other person to weigh the bread.

(3) If any person acts in contravention of this section he shall be liable on summary conviction to a fine not exceeding five pounds.

3.—(1) For the purposes of this Act the local authority shall be the local authority for the purposes of the Weights and Measures Acts, 1878 to 1919, and the expenses of a local authority under this Act shall be defrayed in the same manner as the expenses of a local authority under those Acts.

(2) It shall be the duty of the local authority to execute and enforce the provisions of this Act and, except in Scotland, to take proceedings for any offences against those provisions.

4.—(1) This Act shall apply to Scotland subject to the following modifications:—

(*a*) Section 1 shall come into operation on the expiration of six months from the passing of the Act.

(*b*) The expression "fancy bread" shall not include a pan loaf, French loaf, crusty loaf, or any loaf of a similar character.

(*c*) The enactments mentioned in Part II of the Schedule to this Act are hereby repealed to the extent specified in the third column of that Schedule as from the expiration of six months from the passing of the Act.

(2) This shall not apply to Ireland.

5.—(1) This Act may be cited as the Sale of Bread Act, 1922.

(2) This Act shall come into operation on the first day of September, Nineteen Hundred and Twenty-two.

(3) The enactments mentioned in Part I of the Schedule to this Act are hereby repealed to the extent specified in the third column of that schedule.

[As already stated, this Bill was withdrawn, but is given here to show the nature of official intentions regarding the control of the baker and his trade.]

APPENDICES

APPENDIX I

TABLE OF THE ASSIZE AND PRICE OF BREAD MADE FROM WHEAT

EXPLANATION.—Column No. 1 contains the price of the bushel of wheat (Winchester Measure), from 5*s.* to 14*s.* 6*d.*, the allowance of the Magistrate or Justices to the Baker for baking being included; and in Columns No. 2, under the title of *The Assize Table*, will be found the weights of the several loaves; while in Columns No 3, under the head *Price Table*, the prices of the peck, half-peck, and quartern loaves are stated. So that, for example, if the price of wheat in the market is 5*s.* the bushel, and the Magistrates allow 1*s.* 6*d.* for baking, find 6*s.* 6*d.* in Column No. 1, and even therewith, under Columns No. 2, or *The Assize Table*, will be found the weights of the several loaves which go under the name of *Assize Bread*, and under Columns No. 3, or *The Price Table*, the prices of the loaves which are included under the denomination of *Priced Bread.*

No. 1.	No. 2.—THE ASSIZE TABLE.										No. 3.—THE PRICE TABLE.					
Price of the Bush. Wheat and Baking.	LARGE ASSIZE BREAD.						SMALL ASSIZE BREAD.				PRICED BREAD.					
	Eighteenpenny Loaf.		Twelvepenny Loaf.		Sixpenny Loaf.		Twopenny Loaf.		Penny Loaf.		Peck Loaf.		Half-peck Loaf.		Quartern.	
	Wheaten.	Household.	Wheaten.	Household.	Wheaten.	H'hold.	Wheaten.	H'hold.	Wheat.	H'hold.	Wheaten.	H'hold.	Wheaten.	H'hold.	Wheaten.	H'hold.
s. d.	lb. oz. dr.	lb. oz. dr.	lb. oz. dr.	lb. oz. dr.	lb. oz. dr.	lb. oz. dr.	lb. oz. dr.	lb. oz. dr.	oz. dr.	oz. dr.	s. d. f.	s. d. f.	s. d. f.	s. d. f.	s. d. f.	s. d. f.
5 0	13 9 10	18 6 7	9 1 1	12 4 4	4 8 9	6 2 2	1 8 3	2 0 11	12 1	16 6	1 11 0	1 5 0	0 11 2	0 8 2	0 5 3	0 4 1
5 3	13 0 9	17 6 1	8 11 1	11 9 6	4 5 8	5 12 11	1 7 3	1 14 14	11 9	15 7	2 0 0	1 6 0	1 0 0	0 9 0	0 6 0	0 4 2
5 6	12 8 3	16 7 7	8 5 8	10 15 10	4 2 12	5 7 13	1 6 4	1 13 4	11 2	14 10	2 1 0	1 7 0	1 0 2	0 9 2	0 6 1	0 4 3
5 9	11 13 0	16 0 11	7 14 0	10 11 2	3 15 0	5 5 9	1 5 0	1 12 8	10 8	14 4	2 2 2	1 7 2	1 1 1	0 9 3	0 6 2	0 5 0
6 0	11 6 4	15 4 2	7 9 8	10 2 12	3 12 12	5 1 6	1 4 4	1 11 2	10 2	13 9	2 3 2	1 8 2	1 1 3	0 10 1	0 7 0	0 5 1
6 3	10 14 6	14 10 9	7 4 4	9 12 6	3 10 2	4 14 3	1 3 6	1 10 1	9 11	13 1	2 4 3	1 9 1	1 2 1	0 10 3	0 7 1	0 5 2
6 6	10 6 13	14 3 8	6 15 4	9 7 11	3 7 10	4 11 13	1 2 9	1 9 4	9 4	12 10	2 6 0	1 10 0	1 3 0	0 11 0	0 7 2	0 5 2
6 9	10 1 7	13 9 10	6 11 10	9 1 1	3 5 13	4 8 9	1 1 15	1 8 3	9 0	12 1	2 7 0	1 11 0	1 3 2	0 11 2	0 7 3	0 5 3
7 0	9 12 7	13 0 9	6 8 4	8 11 1	3 4 2	4 5 8	1 1 6	1 7 3	8 11	11 9	2 8 0	2 0 0	1 4 0	1 0 0	0 8 0	0 6 0
7 3	9 7 11	12 8 3	6 5 2	8 5 8	3 2 9	4 2 12	1 0 14	1 6 4	8 7	11 2	2 9 0	2 1 0	1 4 2	1 0 2	0 8 1	0 6 1
7 6	9 3 3	12 0 8	6 2 2	8 0 5	3 1 1	4 0 3	1 0 6	1 5 6	8 3	10 11	2 10 0	2 2 0	1 5 0	1 1 0	0 8 2	0 6 2
7 9	8 13 12	11 10 15	5 14 8	7 12 10	2 15 4	3 14 5	0 15 12	1 4 12	7 14	10 6	2 11 1	2 2 3	1 5 2	1 1 2	0 8 3	0 6 3
8 0	8 9 4	11 6 4	5 11 8	7 9 8	2 13 12	3 12 12	0 15 4	1 4 4	7 10	10 2	3 0 2	2 3 2	1 6 1	1 1 3	0 9 1	0 6 3
8 3	8 3 11	11 2 12	5 7 13	7 7 3	2 11 14	3 11 9	0 14 10	1 3 14	7 5	9 15	3 2 0	2 4 0	1 7 0	1 2 0	0 9 2	0 7 0

8	6	8	0	5	10	12	9	5	5	9	7	3	1	2	10	12	3	9	8	0	14	4	1	3	3	7	2	9	9	3	3	0	2	5	0	1	7	2	1	2	2	0	9	3	0	7	1
8	9	7	13	2	10	6	13	5	3	7	6	15	4	2	9	11	3	7	10	0	13	14	1	2	9	6	15	9	4	3	4	0	2	6	0	1	8	0	1	3	0	0	10	0	0	7	2
9	0	7	10	1	10	1	1	5	1	6	6	11	6	2	8	11	3	5	11	0	13	9	1	1	14	6	13	8	15	3	5	0	2	7	0	1	8	2	1	3	2	0	10	1	0	7	3
9	3	7	6	5	9	13	10	4	14	14	6	9	2	2	7	7	3	4	9	0	13	2	1	1	8	6	9	8	12	3	6	1	2	7	3	1	9	0	1	3	3	0	10	2	0	8	0
9	6	7	3	11	9	8	13	4	13	2	6	5	14	2	6	9	3	2	15	0	12	14	1	1	0	6	7	8	8	3	7	1	2	8	3	1	9	3	1	4	1	0	10	3	0	8	1
9	9	7	0	8	9	5	10	4	11	0	6	3	12	2	5	8	3	1	14	0	12	8	1	0	10	6	4	8	5	3	8	2	2	9	2	1	10	1	1	4	3	0	11	0	0	8	1
10	0	6	12	13	9	2	13	4	8	9	6	1	14	2	4	4	3	0	15	0	12	1	1	0	5	6	1	8	2	3	10	0	2	10	0	1	11	0	1	5	0	0	11	2	0	8	2
10	3	6	10	8	8	15	0	4	7	0	5	15	5	2	3	8	2	15	11	0	11	13	0	15	14	5	15	7	15	3	11	0	2	11	0	1	11	2	1	5	2	0	11	3	0	8	3
10	6	6	8	4	8	11	0	4	5	8	5	12	11	2	2	12	2	14	5	0	11	9	0	15	7	5	13	7	12	4	0	0	3	0	0	2	0	0	1	6	0	1	0	0	0	9	0
10	9	6	6	2	8	7	9	4	4	2	5	10	6	2	2	1	2	13	3	0	11	6	0	15	1	5	11	7	9	4	1	0	3	1	0	2	0	2	1	6	2	1	0	1	0	9	1
11	0	6	4	2	8	3	11	4	2	12	5	7	3	2	1	6	2	11	14	0	11	2	0	14	10	5	9	7	5	4	2	0	3	2	0	2	1	0	1	7	0	1	0	2	0	9	2
11	3	6	1	5	8	0	13	4	0	14	5	5	4	2	0	7	2	10	15	0	10	13	0	14	5	5	6	7	3	4	3	1	3	2	3	2	1	3	1	7	1	1	0	3	0	9	3
11	6	5	15	10	7	15	2	3	15	12	5	4	12	1	15	14	2	10	6	0	10	10	0	14	2	5	5	7	1	4	4	2	3	3	2	2	2	1	1	7	3	1	1	0	0	10	0
11	9	5	12	11	7	13	2	3	13	13	5	3	7	1	14	14	2	9	11	0	10	5	0	13	14	5	2	6	15	4	6	0	3	4	0	2	3	0	1	8	0	1	1	2	0	10	0
12	0	5	11	0	7	10	1	3	12	11	5	1	6	1	14	5	2	8	11	0	10	2	0	13	9	5	1	6	13	4	7	0	3	5	0	2	3	2	1	8	2	1	1	3	0	10	1
12	3	5	9	6	7	7	3	3	11	9	4	15	7	1	13	13	2	7	12	0	9	15	0	13	4	4	15	6	10	4	8	0	3	6	0	2	4	0	1	9	0	1	2	0	0	10	2
12	6	5	7	13	7	4	7	3	10	9	4	13	10	1	13	4	2	6	13	0	9	12	0	12	15	4	14	6	8	4	9	0	3	7	0	2	4	2	1	9	2	1	2	1	0	10	3
12	9	5	6	5	7	1	12	3	9	8	4	11	13	1	12	12	2	5	15	0	9	9	0	12	10	4	13	6	5	4	10	0	3	8	0	2	5	0	1	10	0	1	2	2	0	11	0
13	0	5	3	13	7	0	8	3	7	14	4	11	0	1	11	15	2	5	8	0	9	5	0	12	8	4	11	6	4	4	11	2	3	8	2	2	5	3	1	10	1	1	3	0	0	11	1
13	3	5	1	15	6	15	4	3	6	10	4	10	2	1	11	5	2	5	1	0	9	2	0	12	6	4	9	6	3	5	1	0	3	9	0	2	6	2	1	10	2	1	3	1	0	11	1
13	6	5	1	0	6	12	13	3	6	0	4	8	9	1	11	0	2	4	4	0	9	0	0	12	1	4	8	6	1	5	2	0	3	10	0	2	7	0	1	11	0	1	3	2	0	11	2
13	9	4	15	5	6	10	8	3	4	14	4	7	0	1	10	7	2	3	8	0	8	13	0	11	13	4	7	5	15	5	3	0	3	11	0	2	7	2	1	11	2	1	3	3	0	11	3
14	0	4	14	3	6	8	4	3	4	2	4	5	8	1	10	1	2	2	12	0	8	11	0	11	9	4	5	5	13	5	4	0	4	0	0	2	8	0	2	0	0	1	4	0	1	0	0
14	3	4	12	11	6	6	2	3	3	2	4	4	2	1	9	9	2	2	1	0	8	8	0	11	6	4	4	5	11	5	5	0	4	1	0	2	8	2	2	0	2	1	4	2	1	0	1
14	6	4	11	6	6	4	2	3	2	4	4	2	12	1	9	2	2	1	6	0	8	6	0	11	2	4	3	5	9	5	6	0	4	2	0	2	9	0	2	1	0	1	5	0	1	0	2

REMARKS.—The weights of the wheaten loaves are three-fourths of the weights of the household loaves; and if the Magistrates or Justices shall think fit to allow of any white loaves of the price of one penny or twopence, they are to weigh, at all times, three-fourths of the weight of the wheaten loaves of the same price.

The prices of the household loaves are always three-fourths of the prices of the wheaten loaves; and where it should be thought proper to allow of half-quartern loaves, the prices of such loaves (if sold singly) are to be half a farthing higher than is allowed by this Table, when it shall so happen that the farthing is split.

Magistrates and Justices, within their respective jurisdictions, being to set the Assize and fix the price of the several loaves of bread, having respect to the price which the grain, meal, or flour, of which the same are made, shall bear in the market; but no provision being made how they should know what price the respective sorts of meal and flour should be esteemed to bear, in proportion to the price of wheat, they are therefore to take notice, That the peck loaf of each sort of bread is to weigh, when well baken, 17 lb. 6 oz. avoirdupois, and the rest in proportion; and that every sack of meal or flour is to weigh 2 cwt. 2 qr. net; and that from every sack of meal or flour there ought to be produced, on an average, 20 such peck loaves of bread; and, by observing the said Rule, Magistrates and Justices may at all times know if the Baker hath more or less than the allowance they intend to give him.

APPENDIX II

CASE LAW OF THE BREAD ACTS

Extract from a Lecture to the Association of Inspectors of Weights and Measures on May 7th, 1909, by Mr. H. Van Tromp, Inspector of Weights and Measures, South Staffordshire.

I.—SALE BY WEIGHT

Date.	Case.	Short Facts.	Result.
1851	R. *v.* Kingsby 15 J.P. 65; 16 L.T. 48.	Refusal to weigh.	Conviction affirmed.
1867	Jones *v.* Huxtable 31 J.P. 534; 16 L.T. 381.	Quartern loaf demanded. Not weighed. $2\frac{1}{2}$ oz. deficient of 4 lb. Contended (1) That the law does not require bread to be weighed unless on request. (2) That the weighing of dough is sufficient compliance.	Held. Not a sale by weight.
1867	Williams *v.* Deggan 31 J.P. 807; 16 L.T. 492.	Quartern loaf. Unweighed. 5 oz. deficient.	Conviction affirmed.
1869	Milton *v.* Troake 33 J.P. 821; 20 L.T. 563.	"Quart Loaf." 1 oz. deficient. Held to be on all-fours with Jones *v.* Huxtable.	Conviction affirmed.
1869	R. *v.* Kennett R. *v.* Saunders 33 J.P. 824.	"4 lb. loaf" asked for. Not weighed. 6 oz. deficient. Contended that because the loaf was specially baked to make it crusty it could be treated as fancy bread.	Held. Bread or fancy bread must be sold by weight if asked for by weight.

1870	Hill *v.* Browning 34 J.P. 774; 22 L.T. 584.	Custom was to charge same price for bread and vary the weight according to market price of corn. Dough weighed but not bread.	Conviction affirmed. Held. That it is weight of bread and not of dough that was intended by the Act.
1891	Copeland *v.* Walker 55 J.P. 809; 65 L.T. 262.	Quartern loaf purchased from cart. Loaf not weighed, although scales were carried. $2\frac{1}{2}$ oz. short of 2 lb.	Held. That conviction was right. (Reference to Sec. 32 of the W. and M. Act, 1889.)
1899	L.C.C. *v.* Read 63 J.P. 757; 81 L.T. 452.	2*d.* loaf asked for. Loaf similar in shape to ordinary bread supplied. Not weighed. 2 oz. short of 2 lb. Magistrates dismissed case on the ground that only a 2*d.* loaf was asked for.	Held. Magistrates wrong. Conviction should have followed.
1902	Cox *v.* Bleins 66 J.P. 407; 86 L.T. 563.	Half-quartern loaf demanded. Loaf with two rolls put into pan of scale against a 2-lb. weight. Scale did not turn.	Held. Not a sale by weight.
1903	Bridge *v.* Passman 68 J.P. 129.	Notice issued to customers, "We sell each loaf as weighing $1\frac{3}{4}$ lb. only. Price $2\frac{1}{2}$*d.*". Purchaser had dealt with baker for some period on these terms. Three loaves weighed by inspector on delivery weighed over $1\frac{3}{4}$ lb.	Held. Sale by weight.
1905	Sleater *v.* Brewsters, Ltd. 2 J.R. 258.	Irish case. Facts on all-fours with L.C.C. *v.* Read.	Held. Justices wrong in dismissing case.
1905	Welch *v.* Cutler 92 L.T. 239; 69 J.P. 149.	Loaf asked for. 3*d.* paid. $\frac{1}{2}$ oz. deficient of 2 lb. Contended that sufficient compliance as loaves had been weighed in batches, three at a time.	Held. Not a sale by weight. Seller would not know weight of particular loaf.
1906	Blackshaw *v.* Swathmore etc. Co-op. Soc. (Reported in Trade Journals).	Loaf of bread demanded. Not weighed. 3*d.* charged. Loaf weighed. 1 oz. over customary weight of district. Previously weighed by shopman. Argued that not a sale by weight within the meaning of Sec. 4.	Held. Justices right in dismissing case.
1908	Houghton *v.* Buxton (Reported in Trade Journals).	Quartern loaves were sold from cart at $5\frac{1}{2}$*d.* Appellant asked for half-quartern and paid $2\frac{3}{4}$*d.* After sale appellant requested carman to weigh loaf. Loaf deficient of 2 oz. Justices held that the purchase, the payment, and the weighing constituted one transaction.	Held. Not a sale by weight.
1908	Matthison *v.* Bindley 72 J.P. 346.	Loaf weighed on being taken out of oven. Bad shape, put aside. Sold by mistake. $1\frac{1}{2}$ oz. deficient. Not weighed to customer.	Held. Not sold by weight.

CASE LAW OF THE BREAD ACTS.—*Continued*

Date.	Case.	Short Facts.	Result.
1908	Evans *v.* Jones 72 J.P. 481.	2-lb. loaf purchased from vanman. By scales and weights in cart, it could be only ascertained that loaf weighed less than 2 lb.	Held. No weighing evidence in reference to a 2-lb. loaf. Conviction affirmed.
1908	Blackledge & Sons, Ltd. *v.* Bolshaw 72 J.P. 383.	Loaves weighed previously to customer entering shop. When handed to customer, who asked for "A 3*d.* best cottage loaf", loaf bore a printed band, "B.'s fancy bread 3*d.* and 1½*d.* per loaf (2*d.* per lb.). Always over-weight varying according to price of flour." Loaf weighed. 1 lb. 12 oz. Proved manager weighed each loaf in course of business, and if it exceeded 1½ lb. similar band was put on.	Held. That there was a weighing with reference to the sale. Appeal upheld.
		II.—FANCY BREAD	
1869	R. *v.* Wood 33 J.P. 823; 20 L T. 654.	Loaf at time of sale held not to be fancy bread, although it would have been sold as such in 1836.	Held. Conviction affirmed.
1873	Aerated Bread Co. *v.* Gregg 37 J.P 388; 28 L.T. 816.	Ordinary bread except that carbonic acid gas was forced into it. Did not resemble what was called fancy bread at time of passing of Act.	Conviction affirmed.
1896	V. V. Bread Co. *v.* Stubbs 60 J.P. 424; 74 L.T. 704.	Two loaves resembling ordinary quartern loaves sold without weighing. Each deficient. Contended. Loaves made by patented process.	Conviction affirmed. Use of superior yeast does not make the loaves "fancy". Loaf must differ in appearance from ordinary bread. The test is what is fancy at the time of sale, not at passing of the Act.
1897	Mills *v.* Allwood Quarter Sessions.	Brown bread. Flour sold to bakers who made loaves in any manner they chose. Contended. That every brown loaf was fancy bread.	Held. Sold as brown loaf. No distinction in shape. One of many kinds of brown bread.
1900	Ettchells *v.* Harrison Not reported.	Bread made of flour, milk, and lard. Not weighed. Like an ordinary cottage loaf in appearance.	Case remitted for justices to convict.

1909	Bailey *v.* Barsley 73 J.P. Reports 138.	Officer asked for small loaf, and bought one for 1*d.* Loaf weighed $10\frac{1}{2}$ oz. Contended. That it was fancy bread because of its small size. Justices held loaf not similar to ordinary bread, but distinctly different, and dismissed case.	Held. That justices could find that bread made up in this way *was* fancy bread. Contention. That bread cannot be fancy unless quality (as well as size and shape) is different to that of ordinary household bread *not* upheld.
		III.—WEIGHING INSTRUMENTS	
1876	Robinson *v.* Cliff 40 J.P. 615; 34 L.T. 689.	Wholesale delivery of bread. No scales in cart.	Conviction affirmed.
1884	Ridgeway *v.* Ward 49 J.P. 150; 51 L.T. 704.	Order given for bread, customer not seeing it weighed.	Held. Weighing by baker previous to delivery not sufficient. Scales must be carried.
1885	Daniel *v.* Whitfield 40 J.P. 694; 53 L.T. 471.	Bread weighed in shop in presence of customer. Afterwards sent to purchaser per cart.	Held. Scales need not be carried.
1894	R. *v.* Smith 58 J.P. 445; 70 L.T. 373.	Bread Acts, 1822, Secs. 8, 9; and 1836, Secs. 6, 7. No scales in shop where bread sold. Sec. provides no penalty. Magistrates refused to hear case. Mandamus asked for.	Rule discharged.
		IV.—LAYING INFORMATION	
1878	Robinson *v.* Cliff 40 J.P.; 34 L.T. 689.	Sec. 31. "48 hours."	Held. That an intervening Sunday is to be exclusive and not to be reckoned as part of the 48 hours. Note that the words, "Within such reasonable time as shall seem fit to the justices" are omitted in the London Act.

APPENDIX III

WEIGHTS AND MEASURES

Throughout this work the weights and measures employed are those of the Metric System, the Avoirdupois Weights, and the Imperial Measures of Capacity. A gill in certain parts of the Midlands and the North of England is understood to be half a pint imperial, but this is a purely local use of the word. The Scotch pint again is a local measure, varying considerably in different districts. In some districts a Scotch pint is about 2 quarts or 4 imperial pints, in others it may be as much as 4½ or even 5 imperial pints. The pint and gill referred to throughout this work are those of the imperial measurement.

In the Midlands a sack of flour weighs 224 lb. (4 bushels); in all other parts of the United Kingdom it weighs 280 lb. (5 bushels). A sack of flour from Australia weighs 200 lb., and the Australian ton is 2000 lb., whilst the imperial ton is 2240 lb. A barrel of flour weighs 196 lb. A bag of flour is always understood as 140 lb. By a quarter of wheat is understood 480 lb. or 8 bushels of 60 lb.

1 oz.	=	28·35	grams.	1 cubic foot	=	28·32	litres.
1 lb.	=	453·6	„	1 gallon	=	4·3435	„
1 gram	=	15·43	grains.	1 quart	=	1·1338	„
1 oz.	=	437·5	„	1 pint	=	·56796	litre.
1 lb.	=	7000	„	1 litre	=	61·03	c. in.
1 kilogram	=	2·2	lb.			or ·22 of 1 gallon.	
1 cubic inch	=	16·386	c. c.				

CAPACITY OF SCOTCH MEASURES

After the Act of Union of England and Scotland was passed the English weights and measures were introduced in Scotland. But in spite of the law many of the old measures continue in use, although their comparative values with imperial measures are unknown to the present generation. Thus in many Scottish bakeries the stone of flour is still 16 lb.; wheat is calculated by the firlot and the boll. The following list of old Scotch measures will be serviceable for reference:—

Scotch Dry Measure:

4 lippies = 1 peck; 4 pecks = 1 firlot; 4 firlots = 1 boll; 16 bolls = 1 chalder.

The Linlithgow wheat firlot, which was the Scotch standard, contains 21¼ Scotch pints, or 2197⅓ English cubic inches. It was used for wheat, rye, pease, beans, salt, and grass seeds. The barley firlot, which was used for barley, malt, oats, fruit, and potatoes, contains 31 Scotch pints, or 3205½ cubic inches. The former equals $1\frac{1}{46}$ and the latter 1½ Winchester bushels nearly.

Scotch Liquid Measure:

4 gills = 1 mutchkin; 2 mutchkins = 1 choppin; 2 choppins = 1 pint; 2 pints = 1 quart; 4 quarts = 1 gallon; 16 gallons = 1 hogshead.

The Scotch pint, according to the standard Stirling jug, is 103,404 English cubic inches. Hence 105 Scotch pints = 47 English wine gallons, and 11 Scotch

pints = 6 English ale gallons. The Scotch quart is commonly reckoned about $\frac{1}{10}$ less than the English wine gallon and about $\frac{1}{4}$ less than the English ale gallon.

APPENDIX IV

USEFUL CONSTANTS AND DATA FOR REFERENCE

1 litre of hydrogen weighs ·0896 gram.
11·2 litres " " 1 gram.

Specific gravity of air compared with hydrogen is 14·43.

Weight of Water

1 gallon = 10 lb.	1 gill = 5 oz.
1 quart = $2\frac{1}{2}$ "	1 c. c. = 1 gram.
1 pint = $1\frac{1}{4}$ "	

Latent heat of steam = 537 H.U. (965 F.).
" " water = 79 H.U. (142·6 F.).

To convert degrees Centigrade into degrees Fahrenheit and vice versa. C. to F.—Multiply by 9 and divide by 5 and add 32. F. to C.—Subtract 32, then multiply by 5 and divide by 9.

Amount of oxygen and equivalent quantity of air required to burn 1 lb. of following fuels:—

Fuel.	Oxygen.	Air.
Hydrogen	8 lb.	... 35 lb.
Pure carbon to CO	$1\frac{1}{3}$ "	... $5\frac{1}{2}$ "
" " CO_2	$2\frac{2}{3}$ "	... 11 "
Dried wood ...	10 oz.	... $2\frac{1}{2}$ "
" peat ...	$12\frac{1}{2}$ "	... $3\frac{1}{4}$ "
Coke	$2\frac{2}{3}$ lb.	... 10 "
Coal	$1\frac{1}{4}$ "	... 4 "

Approximate combining weights of the elements:—

Hydrogen ... H = 1	Calcium ... Ca = 40
Oxygen ... O = 16	Sodium ... Na = 23
Carbon ... C = 12	Potassium K = 39·1
Nitrogen ... N = 14	Magnesium Mg = 23·9
Sulphur ... S = 32	Aluminium Al = 27
Chlorine ... Cl = 35·4	

Percentage of dry crude gluten in flour from various wheats:—

Scotch	8 %	Kansas ...	9 to 12 %
English ...	8 to 10 %	Michigan...	10 " 11 %
French ...	7 " 9 %	Manitoba...	10 " 15 %
Russian ...	10 " 14 %	Illinois ...	8 " 10 %
Hungarian	8 " 11 %	Ohio ...	7 " 9 %
Indian ...	10 " 13 %	Californian	7 " 9 %
Minnesota	11 " 15 %	Australian	8 " 11 %

British-milled flours from mixed wheats are about the same strength as Kansas with 10 to 11 % dry gluten. Flour for bread should not have less than 10·5 % of dry gluten.

The specific heat of flour or the amount of heat required to raise the temperature of 1 lb. of flour through 1° = ·45 heat unit.

Most strong flours take half their weight of water to make dough for cottage bread. Tin bread requires a softer dough.

APPENDIX V

DISHES IN SEASON

Turkeys from November to March.
Grouse from August 12 to December 9.
Partridges from September 1 to February 11.
Pheasants from October.
Quails all the year.
Fowls all the year.
Larks during the winter months.
Plovers' Eggs from middle of April to middle of May.
Rolled Spiced Beef all the year.
Pressed Beef all the year.
Dressed Ox Tongues all the year.
Pork from September to April.
Salmon from May to October.
Galantine of Chicken and Veal all the year.
Boar's Head all the year.
Pigeons all the year.

APPENDIX VI

DATES OF WHEAT HARVESTS OF THE WORLD

January.—Australia, New Zealand, Chile, and Argentina.

February and March.—East India and Upper Egypt.

April.—Lower Egypt, Syria, Cyprus, Persia, Asia Minor, India, Mexico, and Cuba.

May.—Algeria, Central Asia, China, Japan, Morocco, Texas, and Florida.

June.—Turkey, Greece, Italy, Spain, Portugal, S. France, California, Oregon, Kansas, &c.

July.—Roumania, Austria, Hungary, S. Russia, Germany, France, South of England, &c.

August.—Belgium, Holland, Great Britain, Manitoba, &c.

September and October.—Scotland, Sweden, Norway, and N. Russia.

November.—Peru and S. Africa.

December.—Burma.

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